NAiS

PROGRAMMABLE CONTROLLER

FP0

User's Manual

[Applicable PLC]

- FP0-C10
- FP0-C14
- FP0-C16
- FP0-C32
- FP0-T32
- FP0-SL1
- FP0-E8
- FP0-E16
- FP0-E32

FP0 User's Manual
ARCT1F389E '04.3

Introduction

This manual explains hardware configurations, installation, wiring procedures, I/O allocations and maintenance.

Before You Start

Installation environment

Do not use the unit where it will be exposed to the following:

- **Direct sunlight and ambient temperatures outside the range of 0_C to 55_C/32_F to 131_F.**
- **Ambient humidity outside the range of 30% to 85% RH and sudden temperature changes causing condensation.**
- **Inflammable or corresive gas.**
- **Excessive vibration or shock.**
- **Excessive airborne dust or metal particles**
- **Water in any from including spray or mist.**
- **Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.**
- **Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.**

Static electricity

- **In dry locations, excessive static electricity can cause problems. Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.**

Cleaning

- **Do not use thinner based cleaners because they deform the unit case and fade the colors.**

Power supplies

- **An insulated power supply with an internal protective circuit should be used. The power supply for the FP0 control unit operation is a non-insulated circuit, so if an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed. If using a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.**

Power supply sequence

- **Have the power supply sequence such that the power supply of the FP0 control unit turns OFF before the power supply for I/O.**
- **If the power supply for I/O is turned OFF before the power supply of FP0 control unit, the FP0 control unit will detect the input fluctuations and may begin an unscheduled operation.**

Before turning ON the power

When turning ON the power for the first time, be sure to take the precautions given below.

- **When carrying out construction, check to make sure that there are no scraps of wiring, particularly conductive fragments, adhering to the unit.**
- **Verify that the power supply wiring, I/O wiring, and power supply voltage are all correct.**
- **Sufficiently tighten the installation screws and terminal screws.**
- **Set the mode switch to PROG. mode.**

Table of Contents

Chapter 1 Overview

Chapter 2 Control Units

Chapter 3 Expansion I/O Units

Chapter 4 S-LINK Control Unit

Chapter 5 I/O Allocation

Chapter 6 Installation

Chapter 7 Wiring

Chapter 8 Precautions During Programming

Chapter 9 High-speed Counter/Pulse Output/ PWM Output

Chapter 10 General-use Serial Communications

Chapter 11 Self-Diagnostic and Troubleshooting

Chapter 12 Specifications

Appendix A Dimensions

Chapter 1

Overview

1.1 Components

1.1.1 FP0 Control Units

Product name	Built-in memory (Program capacuty)	Specifications						Part No.	Product No.
		Number of I/O points		Power supply voltage	Input	Output	Connection type		
FP0 C10 Control Unit	EEPROM (2.7k steps)	10	Input: 6 Output: 4	24 V DC	24 V DC Sink/Sourse (±common)	Relay out-put: 2 A	Terminal block	FP0-C10RS	AFP02123
							Molex connector	FP0-C10RM	AFP02113
FP0 C10 Control Unit with RS232C port	EEPROM (2.7k steps)	10	Input: 6 Output: 4	24 V DC	24 V DC Sink/Sourse (±common)	Relay out-put: 2 A	Terminal block	FP0-C10CRS	AFP02123C
							Molex connector	FP0-C10CRM	AFP02113C
FP0 C14 Control Unit	EEPROM (2.7k steps)	14	Input: 8 Output: 6	24 V DC	24 V DC Sink/Sourse (±common)	Relay out-put: 2 A	Terminal block	FP0-C14RS	AFP02223
							Molex connector	FP0-C14RM	AFP02213
FP0 C14 Control Unit with RS232C port	EEPROM (2.7k steps)	14	Input: 8 Output: 6	24 V DC	24 V DC Sink/Sourse (±common)	Relay out-put: 2 A	Terminal block	FP0-C14CRS	AFP02223C
							Molex connector	FP0-C14CRM	AFP02213C
FP0 C16 Control Unit	EEPROM (2.7k steps)	16	Input: 8 Output: 8	24 V DC	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-C16T	AFP02343
						Transister otuput: PNP 0.1 A		FP0-C16P	AFP02353
FP0 C16 Control Unit with RS232C port	EEPROM (2.7k steps)	16	Input: 8 Output: 8	24 V DC	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-C16CT	AFP02343C
						Transister otuput: PNP 0.1 A		FP0-C16CP	AFP02353C
FP0 C32 Control Unit	EEPROM (5k steps)	32	Input: 16 Output: 16	24 V DC	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-C32T	AFP02543
						Transister otuput: PNP 0.1 A		FP0-C32P	AFP02553
FP0 C32 Control Unit with RS232C port	EEPROM (5k steps)	32	Input: 16 Output: 16	24 V DC	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-C32CT	AFP02543C
						Transister otuput: PNP 0.1 A		FP0-C32CP	AFP02553C
FP0 T32 Control Unit with RS232C port and Clock/Cal-endar func-tion	EEPROM (10k steps)	32	Input: 16 Output: 16	24 V DC	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-T32CT	AFP02643C
						Transister otuput: PNP 0.1 A		FP0-T32CP	AFP02653C
FP0 S-LINK Control Unit with RS232C port	EEPROM (5k steps)	128 (S-LINK sec-tion)	Input: 64 Output: 64 (S-LINK section)	24 V DC	—	—	Terminal block	FP0-SL1	AFP02700

1.1.2 FP0 Expansion Units

Product name	Specifications						Part No.	Product No.
	Number of I/O points		Power supply voltage	Input	Output	Connection type		
FP0 E8 Expansion Unit	8	Input: 8	—	24 V DC Sink/Sourse (±common)	—	MIL connector	FP0-E8X	AFP03003
	8	Input: 4 Output: 4	24 V DC	24 V DC Sink/Sourse (±common)	Relay output: 2 A	Terminal block	FP0-E8RS	AFP03023
						Molex connector	FP0-E8RM	AFP03013
	8	Input: 8	24 V DC	—	Relay output: 2 A	Terminal block	FP0-E8YRS	AFP03020
	8	Output: 8	—	—	Transister otuput: NPN 0.1 A	MIL connector	FP0-E8YT	AFP03040
					Transister otuput: PNP 0.1 A		FP0-E8TP	AFP03050
FP0 E16 Expansion Unit	16	Input: 16	—	24 V DC Sink/Sourse (±common)	—	MIL connector	FP0-E16X	AFP03003
	16	Input: 8 Output: 8	24 V DC	24 V DC Sink/Sourse (±common)	Relay output: 2 A	Terminal block	FP0-E16RS	AFP03323
						Molex connector	FP0-E16RM	AFP03313
	16	Input: 8 Output: 8	—	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-E16T	AFP03343
					Transister otuput: PNP 0.1 A		FP0-E16P	AFP03353
	16	Output: 16	—	—	Transister otuput: NPN 0.1 A	MIL connector	FP0-E16YT	AFP03340
					Transister otuput: PNP 0.1 A		FP0-E16YP	AFP03350
FP0 E32 Expansion Unit	32	Input: 16 Output: 16	—	24 V DC Sink/Sourse (±common)	Transister otuput: NPN 0.1 A	MIL connector	FP0-E32T	AFP03543
					Transister otuput: PNP 0.1 A		FP0-E32P	AFP03553

Notes

1) **The control units and relay output type expansion units come with a power cable (part number AFP0581).**
   (The transistor output type expansion units need no power cable.)

2) **The terminal block type relay output units have 2 terminal blocks (9 pins) made by Phoenix. Use a 2.5 mm .098 inch wide screwdriver.**
   Preferably use the specific terminal block screwdriver (part number AFP0806, Phoenix type code SZS0, 4 2.5 mm .098 inch) or equivalent.

3) **The connector-type relay output units have 2 connectors made by Nihon Molex (Molex type code 51067-0900, 9 pins).**
   Use the specific Molex connector press-fit tool (part number AFP0805, Nihon Molex type code 57189-5000) or equivalent.

4) **The transistor output units have a press-fit socket for wire-pressed terminal cable and contacts.**
   Use the press-fit tool (part number AXY52000) for wire-pressed terminal cable.

1.1.3 Intelligent Units

Product name	Specifications	Part No.	Product No.
FP0 Thermocouple Unit	K, J, T, R thermocouple, Resolution: 0.1 C	FP0-TC4	AFP0420
	K, J, T, R thermocouple, Resolution: 0.1 C	FP0-TC8	AFP0421
FP Web-Server unit	Unit for connecting FP series/RS232C interface and Ethernet Web-Server function and E-mail sending function	FP-WEB	AFP0610
FP0 Analog I/O unit	Input specifications: Number or channels 2 channels; Input range: 0 to 5 V, -10 to +10 V (Resolution: 1/4000), 0 to 20 mA (Resolution: 1/4000) Output specifications: Number or channels 1 channels; Output range: -10 to +10 V (Resolution: 1/4000), 0 to 20 mA (Resolution: 1/4000)	FP0-A21	AFP0480
FP0 A/D Converter Unit	Input specifications: Number or channels 8 channels; Input range: 0 to 5 V, -10 to +10 V (Resolution: 1/4000), 0 to 20 mA (Resolution: 1/4000)	FP0-A80	AFP0401
FP0 D/A Converter Unit	Output specifications: Number or channels 4 channels; Output range: -10 to +10 V (Resolution: 1/4000), 4 to 20 mA (Resolution: 1/4000)	FP0-A04V	AFP04121
		FP0-A04I	AFP04123

1.1.4 Link Units

Product name	Specifications	Power supply voltage	Part No.	Product No.
FP0 CC-Link Slave Unit	This unit is for making the FP0 function as a slave station of the CC-Link. Only one unit can be connected to the furthest right edge of the FP0 expansion bus. Note: Accuracy will change if an FP0 thermocouple unit is used at the same time. For details, please refer to the catalog or to the CC-Link Unit manual.	24 V DC	FP0-CCLS	AFP07943
FP0 I/O Link Unit	This is a link unit designed to make the FP0 function as a station to MEWNET-F (remote I/O system).	24 V DC	FP0-IOL	AFP0732
C-NET adapter S2 type (for FP0 side)	This is an RS485 adapter designed to allow use of the Computer link function for connecting to a host computer via C-NET. It comes with a 30 cm FP0 tool port cable. A power supply is not required.	—	—	AFP15402
C-NET adapter (RS485) (for computer side)	This is an RS485 adapter designed to allow use of the Computer link function for connecting to a network-connected PLC via C-NET from a host computer.	100 to 240 V DC	—	AFP8536
		24 V DC	—	AFP8532

1.1.5 Power Supply Unit

Product name	Specifications	Part No.	Product No.
FP0 Power supply unit	Input voltage: 100 to 240 V AC Output: 0.6 A, 24 V DC	FP0-PSA1	AFP0631

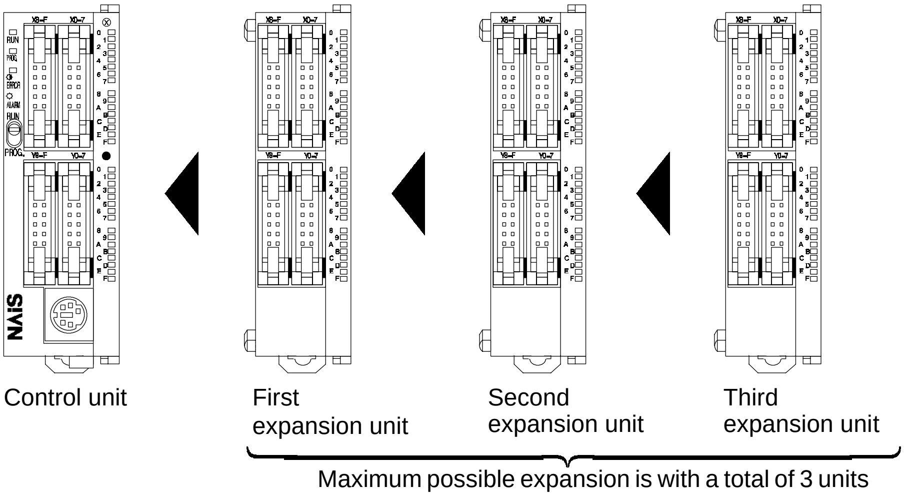
1.1.6 Options and Additional Parts

Product name	Specifications		Product No.
FP Memory loader	Data clear type		AFP8670
	Data hold type		AFP8671
Terminal screwdriver	Relay output type Necessary when wiring terminals block (Phoenix).		AFP0806
Molex connector pressure contact tool	Necessary when wiring relay output type and Molex connectors. (MOLEX: 57189-5000)		AFP0805
Multi-wire connector pressure contact tool	Necessary when wiring transistor output type connectors.		AXY52000
FP0 Slim 30 type mounting plate	Screw-stop attachment plate for 30 mm/1.181 inch width the unit.		AFP0811 (set for 10)
Slim type FP0 mounting plate	Screw-stop attachment plate for FP0 expansion unit. Slim model.		AFP0803 (set for 10)
Flat type FP0 mounting plate	Screw-stop attachment plate for FP0 control unit. Flat model.		AFP0804 (set for 10)
Relay output Molex type I/O cable	Loose-wiring cable (9 leads) AWG20, with Molex socket attached at one end, 0.5 mm^2, 1 set: 2 cables (blue & white).	Length: 1 m/3.281 ft.	AFP0551 (2 cable set)
		Length: 3 m/9.843 ft.	AFP0553 (2 cable set)
Transistor output type I/O cable	Wire-pressed terminal cable (10 leads) AWG22, 0.3 mm^2 with connectors attached at one end, 1 set: 2 cables (blue & white).	Length: 1 m/3.281 ft.	AFP0521 (2 cable set)
		Length: 3 m/9.843 ft.	AFP0523 (2 cable set)
Flat cable connector for FPS/FP0 transistor type unit	If you are using flat cable connector, request the part specified below for a connector with an asymmetrical design to prevent mistaken polarity. (10-pin)		AXM110915
Terminal socket	Attaches to relay output and terminal block type. Additional part		AFP0802 (2 sockets per pack)
Molex socket	Attaches to relay output and Molex connector types. Additional part		AFP0801 (2 sockets per pack)
Wire-press socket	Attaches to transistor output type. Additional part		AFP0807 (2 sockets per pack)
FP0 Power cable	Attaches to FP0 various units. Additional part Length: 1 m/3.281 ft.		AFP0581 (1 socket per pack)

1.2 Expansion Possibilities

Be sure to check that the units are added according to the following restrictions:

- **A maximum of three expansion I/O units or analog I/O units can be connected to one control unit.**
- **There are no restrictions on the combinations of the kind control units and expansion units.**
- **A combination of relay output types and transistor output types is also possible.**
- **The expansion unit can be attached directly to the control unit easily. Special expansion cables, backplanes, and so forth, are unnecessary as the expansion unit employs a stacking system that uses expansion connector and expansion hooks on the surface of the unit itself.**



Contollable I/O Points

Type of control unit	Control unit only	When the expansion unit is the same output type as the control unit	When the expansion unit is a transistor output type
C10R	10 points	max. 58 points	max. 106 points
C14R	14 points	max. 62 points	max. 110 points
C16T/C16P	16 points	max. 112 points	max. 112 points
C32/T32	32 points	max. 128 points	max. 128 points

1.3 Combination Possibilities

1.3.1 Relay Output Type Units

Total number of I/O points		Control unit		First expansion I/O unit		Second expansion I/O unit		Third expansion I/O unit
10 Input: 6, Output: 4	=	10 Input: 6, Output: 4						
14 Input: 8, Output: 6	=	14 Input: 8, Output: 6						
18 Input: 10, Output: 8	=	10 Input: 6, Output: 4	+	8 Input: 4, Output: 4				
22 Input: 12, Output: 10	=	14 Input: 8, Output: 6	+	8 Input: 4, Output: 4				
26 Input: 14, Output: 12	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8				
	=	10 Input: 6, Output: 4	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4		
30 Input: 16, Output: 14	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8				
	=	14 Input: 8, Output: 6	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4		
34 Input: 18, Output: 16	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4		
	=	10 Input: 6, Output: 4	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4
38 Input: 20, Output: 18	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4		
	=	14 Input: 8, Output: 6	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4
42 Input: 22, Output: 20	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8		
	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4
46 Input: 24, Output: 22	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8		
	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4	+	8 Input: 4, Output: 4
50 Input: 26, Output: 24	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4
54 Input: 28, Output: 26	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8	+	8 Input: 4, Output: 4
58 Input: 30, Output: 28	=	10 Input: 6, Output: 4	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8
62 Input: 32, Output: 30	=	14 Input: 8, Output: 6	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8	+	16 Input: 8, Output: 8

1.3.2 Transistor Output Type Units

Total number of I/O points		Control unit		First expansion I/O unit		Second expansion I/O unit		Third expansion I/O unit
16 (Input: 8, Output: 8)	=	16 (Input: 8, Output: 8)						
32 (Input: 16, Output: 16)	=	32 (Input: 16, Output: 16)						
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)				
48 (Input: 24, Output: 24)	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)				
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)				
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)		
64 (Input: 32, Output: 32)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)				
	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)		
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)		
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
80 (Input: 40, Output: 40)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)		
	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)		
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
96 (Input: 48, Output: 48)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)		
	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)
112 (Input: 56, Output: 56)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)
128 (Input: 64, Output: 64)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)

1.4 Programming Tools

Standard ladder diagram tool software “FPWIN GR Ver.2”

Type of software		OS (Operating system)	Hard disc capacity	Product No.
FPWIN GR Ver.2 English-language menu	Full type	WINDOWS 95 (OSR2 or higher) / 98/Me/NT (Ver.4.0 or higher) / 2000/XP	40 MB or more	AFPS10520
	Upgraded version			AFPS10520R
	Small type			AFPS11520

Notes

1) **Customers who use the “FPWIN GR Ver.1” can use the “FPWIN GR Ver.2” after purchasing the upgraded version software. (The upgrade version software can be installed only when the “Ver.1.1” has been previously installed)**

2) **Small type version can be used for the “FP-e,” “FPΣ,” “FP0,” “FP1,” and “FP-M” series.**

IEC61131-3-compliant programming tool software FPWIN Pro Ver.4

Type of software		OS (Operating system)	Hard disc capacity	Product No.
FPWIN GR Ver.4 English-language menu	Full type	WINDOWS 95 (OSR2 or higher) / 98/Me/NT (Ver.4.0 or higher) / 2000/XP	100 MB or more	AFPS50540
	Small type			AFPS51540

Note

Small type version can be used for the “FP-e,” “FPΣ,” “FP0,” “FP1,” and “FP-M” series.

Type of computer and suitable cables

Connector	Connector on PLC side	Product No.
D-Sub 9-pin	Mini DIN round 5-pin	AFC8503
	Mini DIN round 5-pin straight type	AFC8503S

Chapter 2

Control Units

☛ next page

2.1 Parts and Terminology

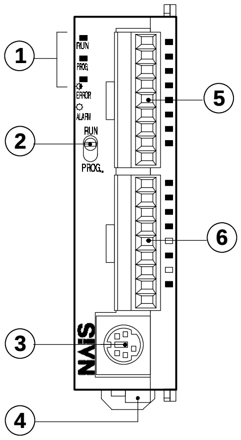
There are sixteen different control unit types available:

1. C10RS terminal type
2. C14RS terminal type
3. C10CRS (with RS232C port) terminal type
4. C14CRS (with RS232C port) terminal type
5. C10RM connector type
6. C14RM connector type
7. C10CRM (with RS232C port) connector type
8. C14CRM (with RS232C port) connector type
9. C16T
10. C16P
11. C16CT (with RS232C port)
12. C16CP (with RS232C port)
13. C32T
14. C32P
15. C32CT (with RS232C port)
16. C32CP (with RS232C port)
17. T32CT (with RS232C port)
18. T32CP (with RS232C port)

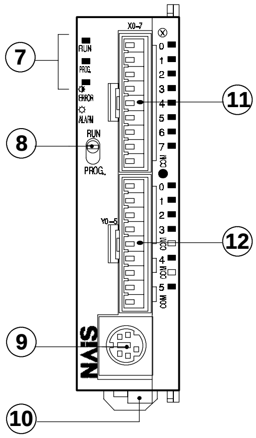
In the next sections you will find a detailed description of each control unit.

2.1.1 Control Unit Types

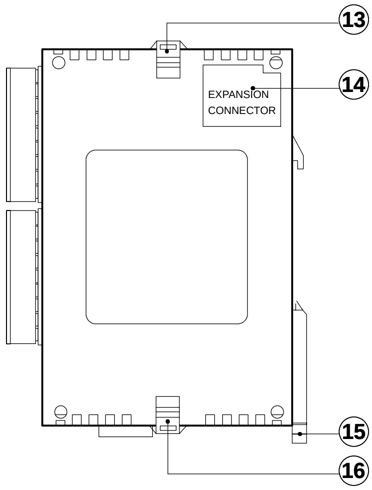
C10RS/C14RS
C10CRS/C14CRS
(terminal type)



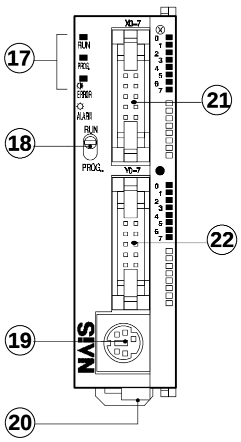
C10RM/C14RM
C10CRM/C14CRM
(connector type)



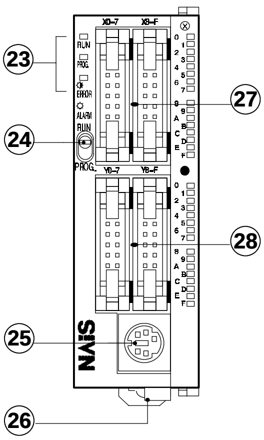
All control unit types



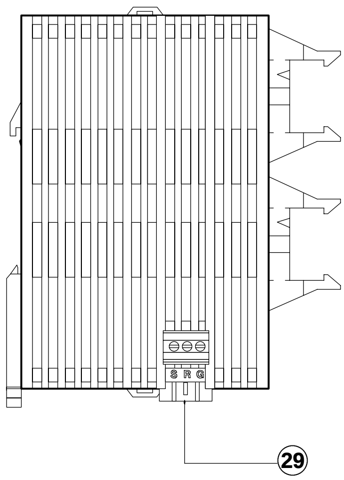
C16T/C16CT
C16P/C16CP



C32T/C32CT
C32P/C32CP
T32CT/T32CP



Control unit with RS232C port



① ⑦ ⑰ ㉓ Status indicator LEDs

display the operation mode and error statuses (*section 2.1.1.1).

② ⑧ ⑱ ㉔ Mode switch

changes the operation mode (*section 2.1.1.2).

③ ⑨ ⑲ ㉕ Tool port (RS232C)

is used to connect a programming tool (*section 2.1.1.3).

④ ⑩ ⑳ ㉖ Power supply connector

Supply 24 V DC. It is connected using the power supply cable (AFP0581) that comes with the unit.

⑤ Input terminal (9-pin)

⑥ Output terminal (9-pin)

The input and output terminals (⑤ and ⑥) use a terminal block socket made by Phoenix Contact Co. (product number: 1840434) (*section 7.6).

⑪ Input connector (9-pin)

⑫ Output connector (9-pin)

The input and output connectors (⑪ and ⑫) use a connector made by Molex Japan Co. (product number: 51067-0900) (*section 7.7).

⑬ ⑯ Expansion hook

is used to secure expansion units. The hook is also used for installation on FP0 flat type mounting plate (AFP0804).

⑭ Expansion connector

connects an expansion unit to the internal circuit of the control unit (*section 6.1).

⑮ DIN rail attachment lever

allows simple attachment to a DIN rail.

The lever is also used for installation on FP0 slim type mounting plate (AFP0803).

㉑ Input connector (10-pin)

㉒ Output connector (10-pin)

Use a MIL type connector for the input and output connectors (㉑ and ㉒) (*section 7.8).

㉗ Input connectors (10-pin × 2)

㉘ Output connectors (10-pin × 2)

Use a MIL type connector for the input and output connectors (㉗ and ㉘) (*section 7.8).

㉙ RS232C port

Use this port to connect to devices with an RS232C port, such as an I.O.P., a bar code reader, or an image checker, enabling data input and output. (*section 7.9).

2.1.1.1 Status Indicator LEDs

These LEDs display the current mode of operation or the occurrence of an error.

LED	Description
RUN (green)	Illuminates when in the RUN mode and indicates the execution of a program. It flashes during forced input/output.
PROG. (green)	Illuminates when in the PROG. mode and indicates that operation has stopped.
ERROR/ALARM (red)	Flashes when an error is detected during the self-diagnostic function. Illuminates if a hardware error occurs, or if operation slows because of the program, and the watchdog timer is activated.

2.1.1.2 Mode Switch

This switch turns ON and OFF (RUN/PROG.) the operation of the FP0. The FP0 can also be turned ON and OFF by the programming tool.

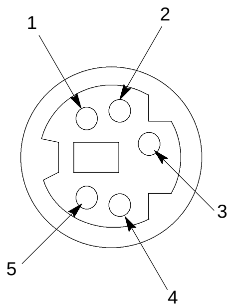
Switch position	Operation mode
RUN (upward)	This sets the RUN mode. The program is executed and operation begins.
PROG. (downward)	This sets the PROG. mode.

When performing remote switching from the programming tool, the position of the mode switch and the actual mode of operation may differ. Verify the mode with the status indicator LED. Otherwise, restart the FP0 and change the mode of operation with the mode switch.

2.1.1.3 Tool Port

The tool port is used to connect a programming tool.

Pin assignment



Pin no.	Abbreviation
1	—
2	SD (TXD)
3	SG
4	RD (RXD)
5	+ 5 V

2.2 Specifications

2.2.1 General Specifications

Item		Description
Rated operating voltage		24 V DC
Operating voltage range		21.6 V to 26.4 V DC
Rated current consumption		300 mA or less (*section 2.2.1.2)
Allowed momentary power off time	**C10/C14**	5 ms at 21.6 V, 10 ms at 24 V
	C16/C32 T32/SL1	10 ms at 21.6 V, 10 ms at 24 V
Ambient temperature		0 °C to +55 °C/32 °F to +131 °F
Storage temperature		-20 °C to +70 °C/-4 °F to +158 °F
Ambient humidity		30 % to 85 % RH (non-condensing)
Storage humidity		30 % to 85 % RH (non-condensing)
Breakdown voltage		500 V AC for 1 minute between I/O terminal and power supply/ground terminal 1500 V AC for 1 minute between I/O terminal and power supply/ground terminal (relay output type only)
Insulation resistance		min. 100 MΩ (measured with a 500 V DC megger) between I/O terminal and ground terminal
Vibration resistance		10 Hz to 55 Hz, 1 cycle/min: double amplitude of 0.75 mm/ 0.030 in., 10 min on 3 axes
Shock resistance		Shock of 98 m/s^2 or more, 4 times on 3 axes
Noise immunity		1,000 Vp-p with pulse widths 50 ns and 1 μs (based on in-house measurements)
Operating condition		Free from corrosive gases and excessive dust

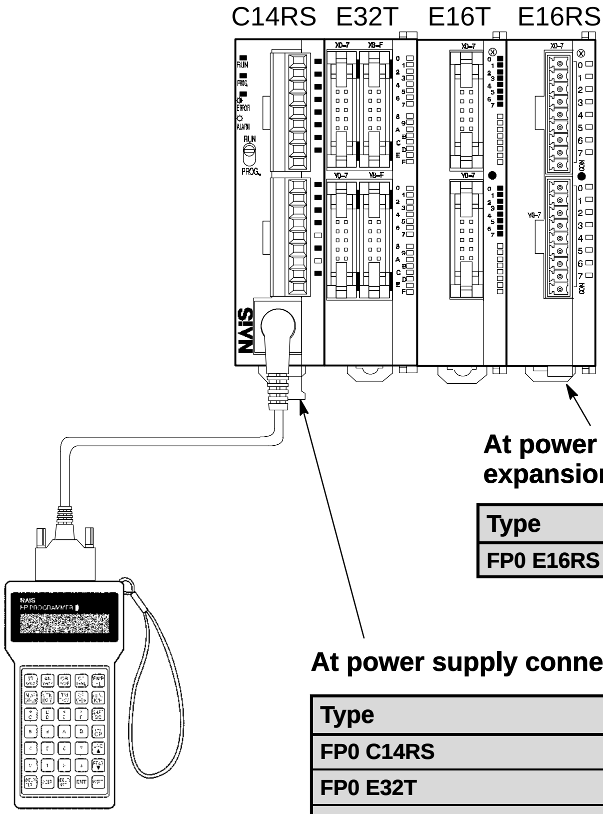
2.2.1.1 Weight

Type	Weight	Type	Weight
C10	approx. 100 g/3.53 oz	**SL1**	approx. 120 g/4.24 oz
C14	approx. 105 g/3.70 oz	**A21**	approx. 80 g/2.82 oz
C16	approx. 85 g/3.00 oz	**A80**	approx. 90 g/3.18 oz
C32	approx. 115 g/4.06 oz	**IOL, TC4**	approx. 85 g/3.00 oz
T32	approx. 125 g/4.41 oz	**TC8**	approx. 95 g/3.35 oz
E8R/E8YR	approx. 90 g/3.17 oz	**CCLS**	approx. 80 g/2.82 oz
E8X/E8YT/E8YP	approx. 65 g/2.29 oz	**A04V/A04I**	approx. 75 g/2.65 oz
E16RS/E16RM	approx. 105 g/3.70 oz		
E16T/E16P/E16X/E16YT/E16YP	approx. 70 g/2.47 oz		
E32T/E32P	approx. 85 g/3.00 oz		

2.2.1.2 Current Consumed by the Control Unit

Unit type		Control unit (The current consumed by the control unit power supply connector. If expansion units or intelligent units are added, the current is increased by the value indicated below.)	Expansion unit (The current consumed by the expansion unit power supply connector. If a unit is not listed below, it means that it has no power supply connector.)	Input circuit (The current consumed by the input circuits of the various units. The value indicates the current that flows into the input circuit. “n” indicates the number of points that are on.)	Output circuit (The current consumed by the output circuits of the various units. The value indicates the current used to drive the output circuit. “n” indicates the number of points that are on. The value does not include the load current value.)
FP0 Control unit	**FP0-C10**	100mA or less	—	25.8mA or less	—
	FP0-C14	100mA or less	—	34.4mA or less	—
	FP0-C16	40mA or less	—	34.4mA or less	28mA or less
	FP0-C32 **FP0-T32**	60mA or less	—	68.8mA or less	52mA or less
S-LINK Control unit	**FP0-SL1**	150mA or less	—	—	—
FP0 Expansion unit	**FP0-E8X**	10mA or less	—	34.4mA or less	—
	FP0-E8R	15mA or less	50mA or less	17.2mA or less	—
	FP0-E8YR	10mA or less	100mA or less	—	—
	FP0-E8YT/P	15mA or less	—	—	24mA or less
	FP0-E16X	20mA or less	—	68.8mA or less	—
	FP0-E16R	20mA or less	100mA or less	34.4mA or less	—
	FP0-E16T/P	25mA or less	—	34.4mA or less	24mA or less
	FP0-E16YT/P	25mA or less	—	—	48mA or less
	FP0-E32T/P	40mA or less	—	68.8mA or less	48mA or less
FP0 Intelligent unit	**FP0-A21**	20mA or less	100mA or less	—	—
	FP0-A80	20mA or less	60mA or less	—	—
	FP0-A04V	20mA or less	100mA or less	—	—
	FP0-A04I	20mA or less	130mA or less	—	—
	FP0-TC4, **FP0-TC8**	25mA or less	—	—	—
	FP0-IOL	30mA or less	40mA or less	—	—
	FP0-CCLS	40mA or less	40mA or less	—	—
Programmable display unit	**AIGT0030B1,** **AIGT0030H1**	80mA or less	—	—	—

Current consumption example



FP Programmer II Ver. 2

At power supply connector of expansion I/O unit FP0 E16RS

Type	Current consumption
FP0 E16RS	100 mA

At power supply connector of control unit

Type	Current consumption
FP0 C14RS	100 mA
FP0 E32T	40 mA
FP0 E16T	25 mA
FP0 E16RS	20 mA
FP Programmer II Ver. 2	50 mA
Total current consumption	235 mA or less

2.2.2 Performance Specifications

Item			Relay output type		Transistor output type			S-LINK type
			C10RS/ C10RM/ C10CRS/ C10CRM	C14RS/ C14RM/ C14CRS/ C14CRM	C16T/ C16P/ C16CT/ C16CP	C32T/ C32P/ C32CT/ C32CP	T32C	SL1
Programming method/Control method			Relay symbol/Cyclic operation					
Controllable I/O points	Basic unit		Total: 10 Input: 6 Output: 4	Total: 14 Input: 8 Output: 6	Total: 16 Input: 8 Output: 8	Total: 32 Input: 16 Output: 16	Total: 32 Input: 16 Output: 16	Max. 128 Input: 64 Output: 64 at S-LINK block
	With expansion unit 1 When configured with same output type as control unit		Max. 58	Max. 62	Max. 112	Max. 128	Max. 128	Max. 96 at expansion block
	With expansion unit 2 When relays and transistors are mixed		Max. 106	Max. 110	Max. 112	Max. 128	Max. 128	
Program memory	Built-in memory		Built in EEPROM (without battery)					
Program capacity			2,720 steps			5,000 steps	10,000 steps	5,000 steps
Numbers of instruction	Basic		83					
	High-level		145					
Operation speed			0.9μs/step (by basic instruction)					
I/O refresh and base time			With no expansion board: 0.3ms With expansion board(s): 0.3ms and (1 x number of expansion boards) ms					
Operation memory points	Relay	Internal relay (R)	1,008 points (R0 to R62F)				1,008 points (R0 to R62F) (* Note 1)	1,008 points (R0 to R62F)
		Special internal relay (R)	64 points (R9000 to R903F)					
		Timer/Counter (T/C)	144 points (initial setting is 100 timer points, T0 to T99 / 44 counter points, C100 to C143 (* Note 2)) Timer range: 1ms, 10ms, 100ms, 1s; selected by instruction					
	Memory area	Data register (DT)	1,660 words (DT0 to DT1659)			6,144 words (DT0 to DT6143)	16,384 words (DT0 to DT16383) (* Note 1)	6,144 words (DT0 to DT6143)
		Special data register (DT)	112 words (DT9000 to DT9111)				112 words (DT90000 to DT90111)	112 words (DT9000 to DT9111)
		Index register (IX, IY)	2 words					
Differential points (DF, DF/)			Unlimited of points					
Master control relay points (MCR)			32 points					
Number of labels (JP and LOOP)			64 labels				255 labels	64 labels

Item		Relay output type		Transistor output type			S-LINK type
		C10RS/ C10RM/ C10CRS/ C10CRM	C14RS/ C14RM/ C14CRS/ C14CRM	C16T/ C16P/ C16CT/ C16CP	C32T/ C32P/ C32CT/ C32CP	T32C	SL1
Number of step ladders		128 stages				704 stages (* Note 1)	128 stages
Number of subroutines		16 subroutines				100 sub-routines	16 sub-routines
Number of interrupt programs		7 programs (external 6 points, internal 1 point)					1 program (internal 1 point)
Self-diagnosis function		Such as watchdog timer, program syntax check					
Clock/calender function		Not available				Available (* Note 3)	Not available
Special functions	**Pulse catch input** / **Interrupt input**	Total 6 points (X0 to X1: 50μs, X2 to X5: 100μs)					Not available
	RS232C port (* Note 4) (Only units with an RS232C port)	Transmission speeds: 300/600/1200/2400/4800/9600/19200bit/s Transmission distance: 3m/9.84ft. Terminal block: 3-pin, made by phoenix Contact Co. (products number: MKDS1/3-3.5) Communication method: Half-duplex					
	Periodical interrupt	0.5ms to 30s interval					
	Constant scan	Available					
	Password	Available					
	High- speed counter function (* Note 5)	**Counter mode:** Addition/subtraction (one phase) (* Note 7) **- Input point number:** Four channels maximum **- Maximum counting speed:** 10kHz maximum for all 4 channels **- Input contacts used:** X0: count input (ch 0) X1: count input (ch 1) X2: reset input (*Note 8) X3: count input (ch 2) X4: count input (ch 3) X5: reset input (*Note 8) **- Minimum input pulse width:** X0, X1 ---------- 50μs, <10kHz> X3, X4 ---------- 100μs, <5kHz>					Not available
		Counter mode: Two-phase/individual/direction decision (two-phase) **- Input point number:** Two channels maximum **- Maximum counting speed:** 2kHz maximum for all 2 channels **- Input contacts used:** X0: count input (ch 0) X1: count input (ch 0) X2: reset input X3: count input (ch 2) X4: count input (ch 2) X5: reset input **- Minimum input pulse width:** X0, X1 ---------- 50μs, <10kHz> X3, X4 ---------- 100μs, <5kHz>					Not available

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="2">Relay output type</th><th colspan="3">Transistor output type</th><th>S-LINK type</th></tr>
<tr><th>C10RS/
C10RM/
C10CRS/
C10CRM</th><th>C14RS/
C14RM/
C14CRS/
C14CRM</th><th>C16T/
C16P/
C16CT/
C16CP</th><th>C32T/
C32P/
C32CT/
C32CP</th><th>T32C</th><th>SL1</th></tr>
<tr><td rowspan="4">Special functions</td><td rowspan="2">Pulse output func-
tion
(* Note 6,10)</td><td>Output point number</td><td colspan="2">Not available</td><td colspan="3">Two independent points (Y0 and Y1)(no interpolation function)</td><td>Not available</td></tr>
<tr><td>Output frequency</td><td colspan="2">Not available</td><td colspan="3">40Hz to 10kHz (Y0/Y1: one-point output)
40Hz to 5kHz (Y0/Y1: two-point output)</td><td>Not available</td></tr>
<tr><td rowspan="2">PWM output func-
tion
(* Note 6)</td><td>Output point number</td><td colspan="2">Not available</td><td colspan="3">Two points (Y0 and Y1)</td><td>Not available</td></tr>
<tr><td>Output frequency</td><td colspan="2">Not available</td><td colspan="2">Frequency: 0.15Hz to 38Hz,
(* Note 9)
Duty: 0.1% to 99.9%</td><td>Frequen-
cy:
0.15Hz to 1KHz
Duty: 0.1% to 99.9%</td><td>Not available</td></tr>
<tr><td rowspan="2">Memory backup
(* Note 6, 12)</td><td colspan="2">Program and system register</td><td colspan="6">EEPROM</td></tr>
<tr><td colspan="2">Operation memory</td><td colspan="3">Areas which are held if the power supply fails are fixed, and are retained by the EEPROM.
- Number of points/words of the fixed hold areas in the various memories
Counters: 4 points
Internal relays: 32 points
Date registers: 8 words
(* Note 13)</td><td>Areas which are held if the power supply fails are fixed, and are retained by the EEPROM.
- Number of points/ words of the fixed hold areas in the various memories
Counters: 16 points
Internal re-
lays: 128 points
Date
registers: 32 words
(* Note 14)</td><td>The opera-
tion memory is backed up using built-in charge-
able (sec-
ondary) battery, so the hold type memory areas can be speci-
fied using the pro-
gramming tools.
(* Note 11)
- Memory areas which can be speci-
fied:
Timers, Counters, Internal re-
lays, Data registers</td><td>Areas which are held if the power supply fails are fixed, and are retained by the EEROM.
- Number of points/ words of the fixed hold areas in the various memories
Counters: 16 points
Internal re-
lays: 128 points
Date registers: 32 words
(* Note 14)</td></tr>
</table>

Notes

1) Hold or non-hold type can be set using the system registers.

2) The proportion of timer points to counter points can be changed using a system register 5.

Notes

3) **Precision of calender timer:**
At 0_C/32_F, less than 139 second error per month.
At 25_C/77_F, less than 72 seconds error per month.
At 55_C/131_F, less than 169 seconds error per month.
This accuracy is considered to be the worst fluctuation coefficient value based on fluctuations in the normal voltage of 5V and the battery backup voltage of 3V. Also, F157 and F158 (time/date addition and subtraction instructions) cannot be used.

4) **When using the RS232C port for communication, we recommend using resend processing. The driver IC for the RS232C is in full conformance with EIA/TIA-232E and CCITT V.28 standards.**

5) **The combinations 1 phase × 2 channels and 2 phases × 1 channel are also possible for the high-speed counter.**

6) **The internal relay, data register, and timer/counter hold areas of the T32CT control unit (10 k step type) can be changed by the system registers. The number of points in the table is the value when the system registers are initial values.**

7) **The max. counting speed (10kHz) is the counting speed with a rated input voltage of 24V DC and an ambient temperature of 25°C. The counting speed (frequency) will decrease depending on the voltage and temperature.**

8) **If both reset inputs X0 and X1 are reset, X2 will be the reset input of X1. In the same way, for X3 and X4, X5 acts as the reset input of X4.**

9) **With a CPU of Ver. 1.2 or a subsequent version, the frequency will be 0.15Hz to 1kHz.**

10) **The maximum is 9.5kHz when the positioning control instruction (F168) is executed.**

11) **Precautions when using the battery backup function Secondary (chargeable) battery is used as backup battery in the FP0 T32C control unit. The battery is not charged before the unit is shipped, so please make sure that the built-in backup battery have been charged before using the unit.**

12) **The program, system resisters and the hold type areas (internal relay, data register and counter) are backed up by the built in EEPROM.**

13) **The possible number of write times by the EEP-ROM write instruction is 100,000 or less.**

14) **The possible number of write times by the EEP-ROM write instruction is 10,000 or less.**

2.2.3 Input Specifications

Item		Description
Insulation method		optical coupler
Rated input voltage		24 V DC
Rated input current		approx. 4.3 mA (at 24 V DC)
Input impedance		approx. 5.6 kΩ
Operating voltage range		21.6 to 26.4 V DC
Input points per common (*Note 1)	**C10RM, C10CRM, C10RS, C10CRS**	6 points/common
	C14RM, C14CRM, C14RS, C14CRS	8 points/common
	C16T, C16CT, C16P, C16CP	8 points/common
	C32T, C32CT, C32P, C32CP T32CT, T32CP	16 points/common
ON voltage/ON current		19.2 V or less/3 mA or less
OFF voltage/OFF current		2.4 V or more/1 mA or more
Response time (at 24 V DC and 25 °C/66 °F)	**OFF ↔ ON**	50 µs or less (at X0, X1) (* Note 2) 100 µs or less (at X2 to X5) (* Note 2) 2 ms or less (at X6 to XF)
	ON ↔ OFF	the same as above
Operating mode indicator		LED

Notes

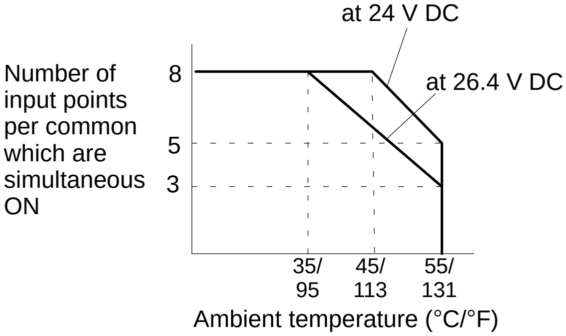
1) **Either positive or negative polarity is possible for the input voltage supply.**

2) **X0 through X5 are inputs for the high-speed counter and have a fast response time. If used as normal inputs, we recommend inserting a timer in the ladder program as chattering and noise may be interpreted as an input signal.**

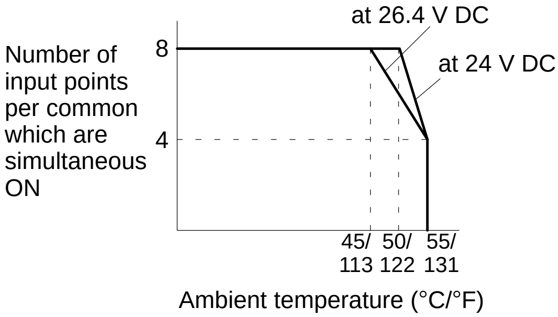
2.2.3.1 Limitations on Number of Simultaneous Input ON Points

Keep the number of input points per common which are simultaneously ON within the following range as determined by the temperature.

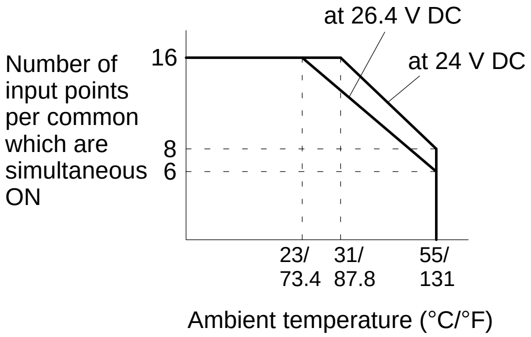
FP0-C14RM/C14CRM/C14RS/C14CRS



FP0-C16T/C16CT/C16P/C16CP



FP0-C32T/C32CT/C32P/C32CP/T32CT/T32CP



2.2.4 Output Specifications

2.2.4.1 Relay Output Type

FP0 relay output types: C10RM, C10CRM, C10RS, C10CRS, C14RM, C14CRM, C14RS, C14CRS

Item		Description
Output type		Normally open (1 Form A) relay output
Rated control capacity		2 A 250 V AC, 2 A 30 V DC (4.5 A maximum per common) (at Resistance load)
Output points per common	**C10RM, C10CRM, C10RS, C10CRS**	2 points/common ＋1 point/common +1 point/common
	C14RM, C14CRM, C14RS, C14CRS	4 points/common + 1 point/common + 1 point/common
Response time	**OFF → ON**	approx. 10 ms
	ON → OFF	approx. 8 ms
Mechanical life time		20,000,000 operations or more
Electrical life time		100,000 operations or more
Surge absorber		None
Operating mode indicator		LED

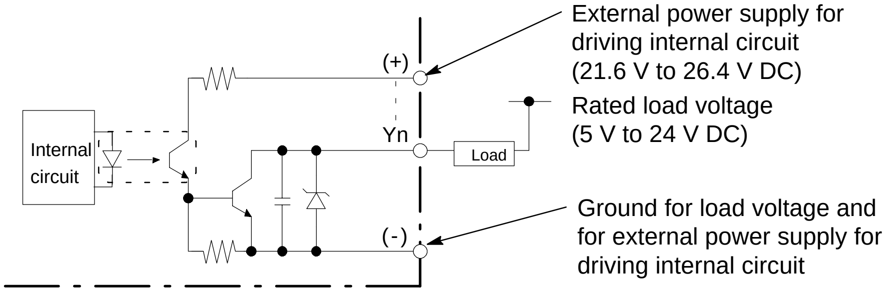
2.2.4.2 Transistor Output Type

FP0 transistor output types: C16T, C16CT, C16P, C16CP, C32T, C32CT, C32P, C32CP, T32CT, T32CP

Item		Description
Insulation method		optical coupler
Output type		open collector
Rated load voltage		NPN open collector type: 5 to 24 V DC (* Note) PNP open collector type: 24 V DC
Operating load voltage range		NPN open collector type: 4.75 to 26.4 V DC PNP open collector type: 21.6 to 26.4 V DC
Max. load current		0.1 A
Max. surge current		0.3 A
Output points per common	**C16T, C16CT, C16P, C16CP**	8 points/common
	C32T, C32CT, C32P, C32CP T32CT, T32CP	16 points/common
OFF state leakage current		100 µA or less
ON state voltage drop		1.5 V or less
External power supply for driving internal circuit	**Voltage**	21.6 to 26.4 V DC
	Current	Y0 and Y1: 5 mA/1 point, except Y0 and Y1: 3 mA/1 point
Response time	**OFF → ON**	1 ms or less (Y0 and Y1 only: 50 µs or less)
	ON → OFF	1 ms or less (Y0 and Y1 only: 50 µs or less)
Surge absorber		Zener diode
Operating mode indicator		LED

Note

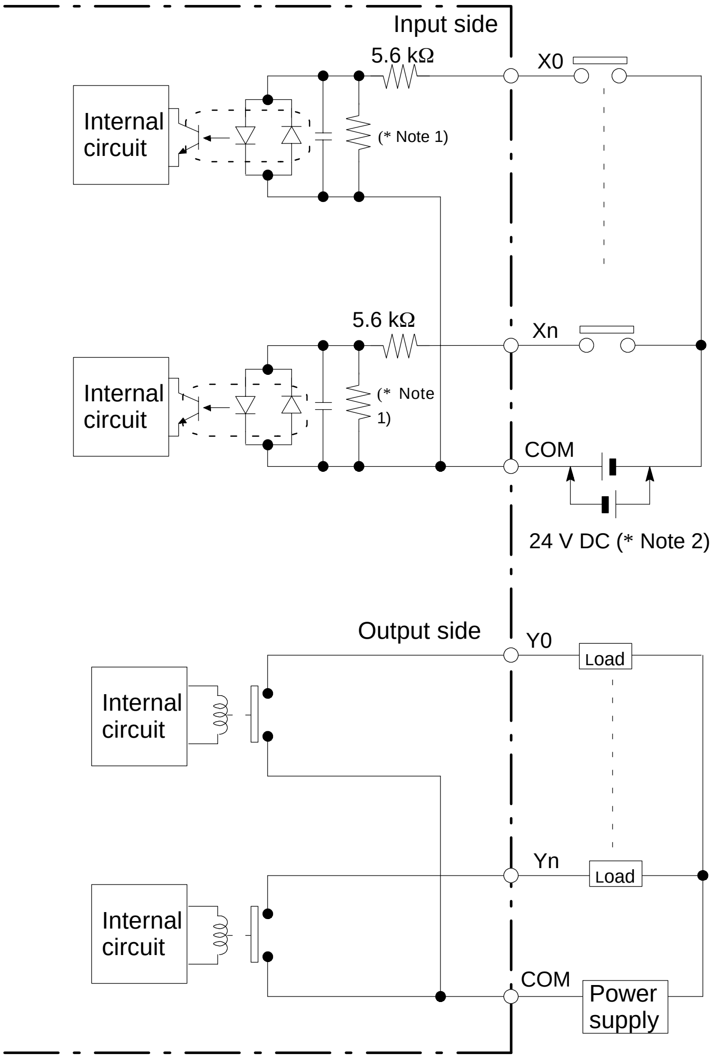
For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.



2.3 Internal Circuit Diagram

2.3.1 Relay Output Type (C10RS/C10CRS/C10RM/C10CRM/C14RS/C14CRS/C14RM/C14CRM)

FP0-C10RS/C10CRS/C10RM/C10CRM/C14RS/C14CRS/C14RM/C14CRM



Notes

1) **The resistor in the control unit is 2 kΩ for X0 through X5, and 1 kΩ for X6 and X7.**

2) **Either positive or negative polarity is possible for the input voltage supply.**

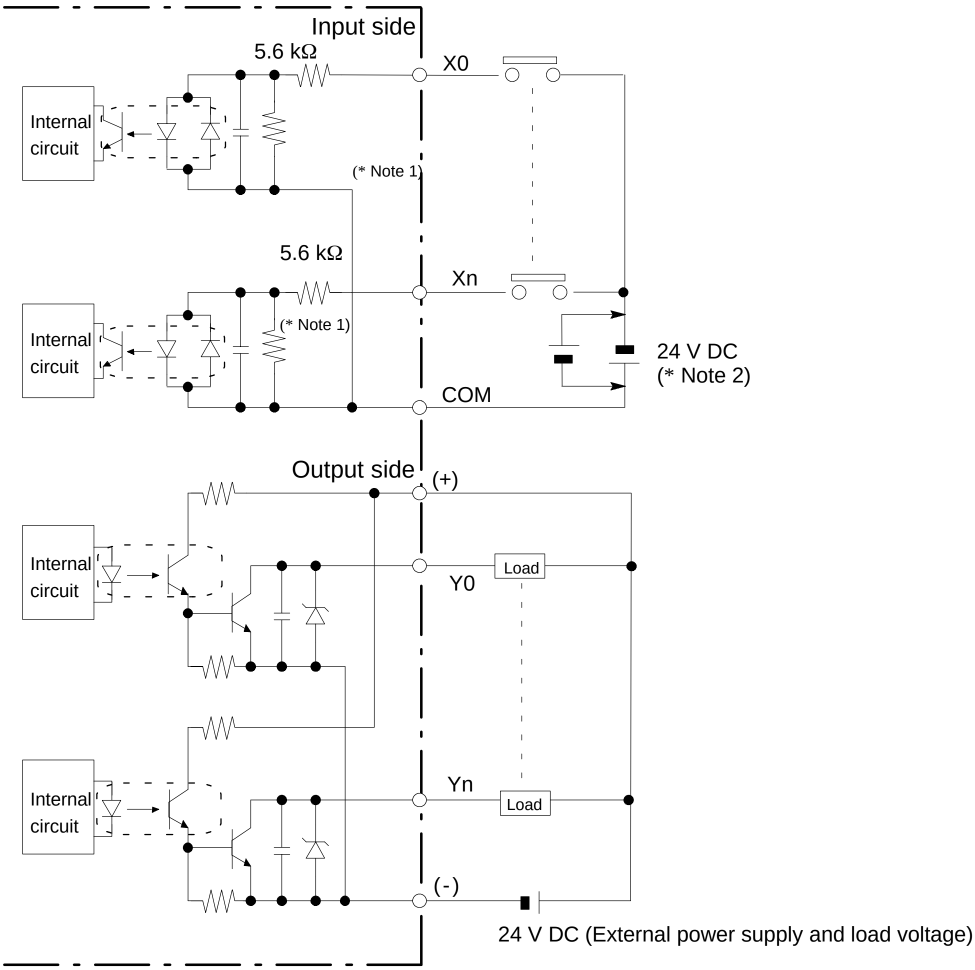
2.3.2 Transistor Output Type

2.3.2.1 NPN Open Collector Type (C16T/C16CT/C32T/C32CT/T32CT)

When the load voltage and external power supply are the same

This example is when the values of the rated load voltage and external power supply for driving internal circuit are the same. In this situation, there is only one power supply.

FP0-C16T/C16CT/C32T/C32CT



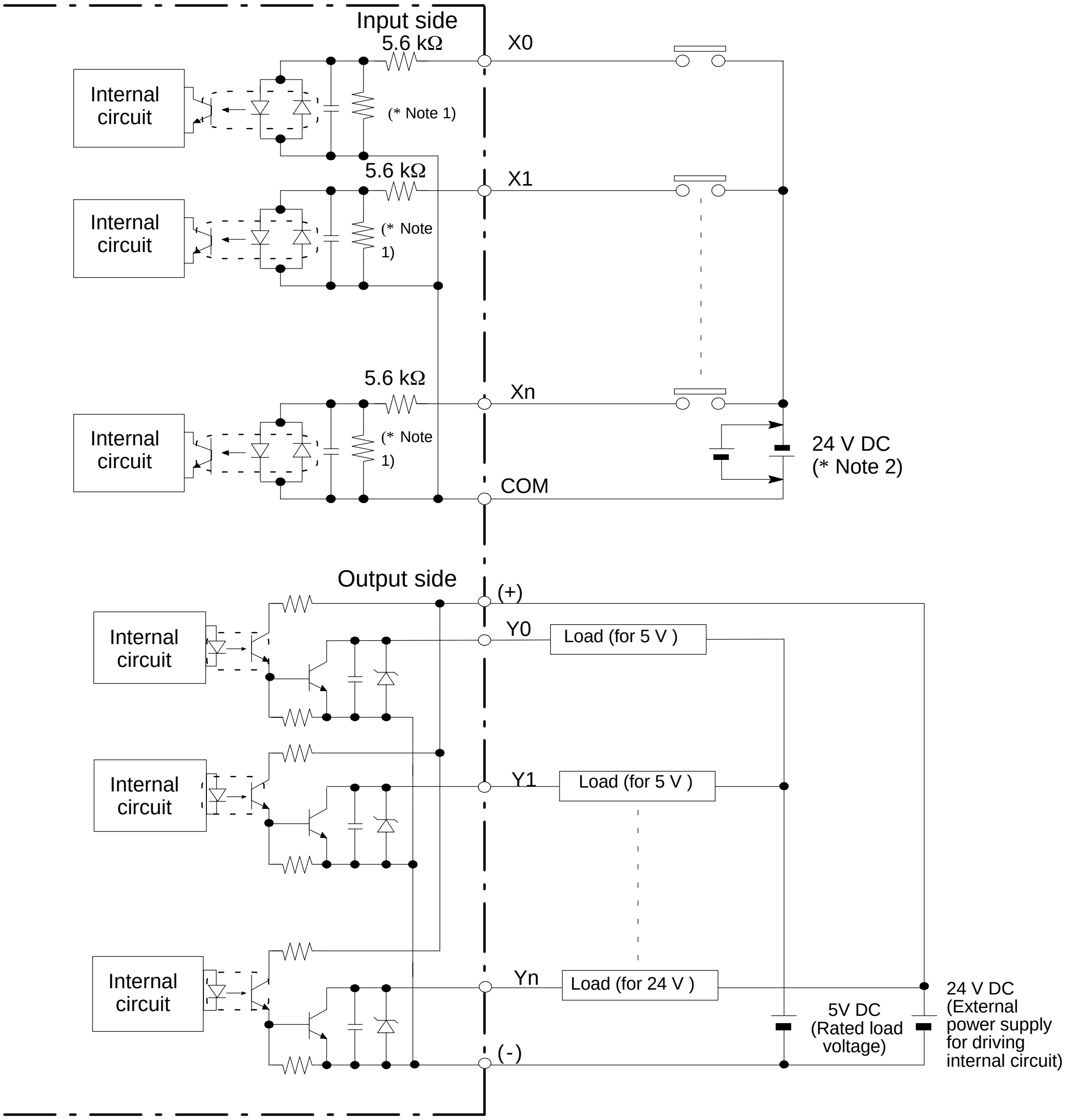
Notes

1) **The resistor in the control unit is 2 kΩ for X0 through X5, and 1 kΩ for X6 through XF.**
2) **Either positive or negative polarity is possible for the input voltage supply.**

When the load voltage differs from the 24 V DC external power supply for the driving the internal circuit

Other than 24 V DC load voltage, 5 V DC and 12 V DC and other load voltages can be connected.

FP0-C16T/C16CT/C32T/C32CT/T32CT

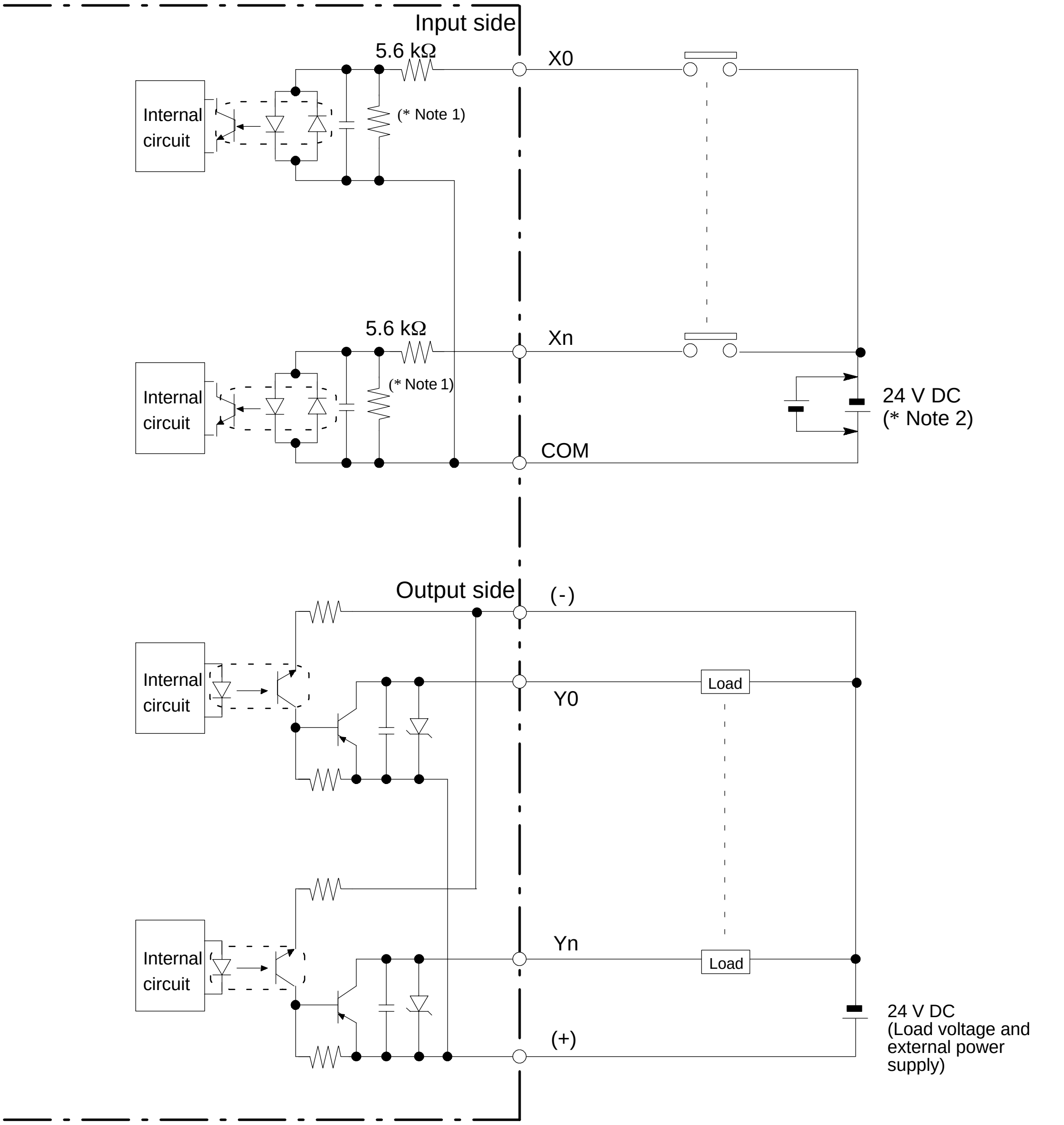


☞ Notes

1) **The resistor in the control unit is 2 kΩ for X0 through X5, and 1 kΩ for X6 through XF.**
2) **Either positive or negative polarity is possible for the input voltage supply.**

2.3.2.2 PNP Open Collector Type (C16P/C16CP/C32P/C32CP/T32CP)

FP0-C16P/C16CP/C32P/C32CP/T32CP

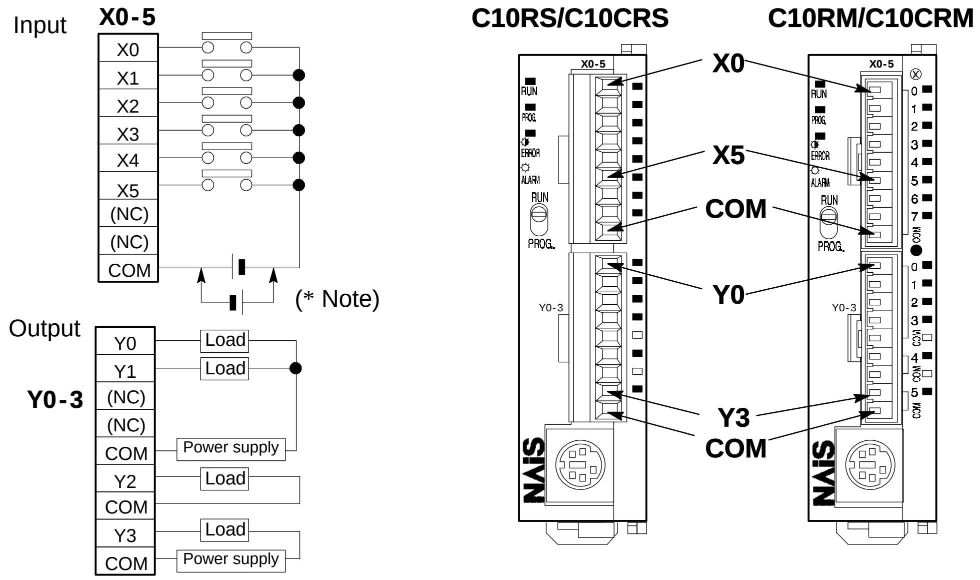


Notes

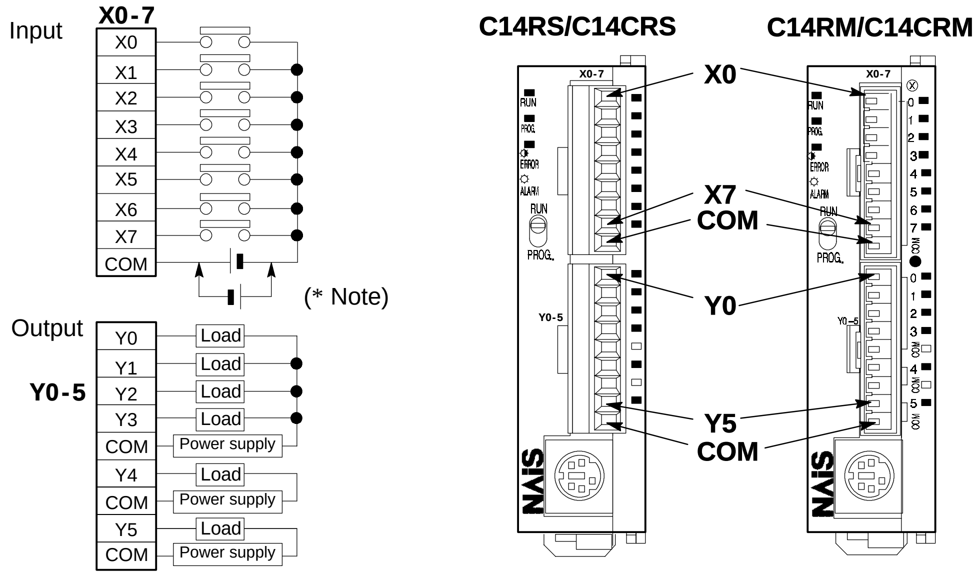
1) **The resistor in the control unit is 2 kΩ for X0 through X5, and 1 kΩ for X6 through XF.**
2) **Either positive or negative polarity is possible for the input voltage supply.**

2.4 Pin Layouts

2.4.1 C10RS/C10CRS/C10RM/C10CRM



2.4.2 C14RS/C14CRS/C14RM/C14CRM

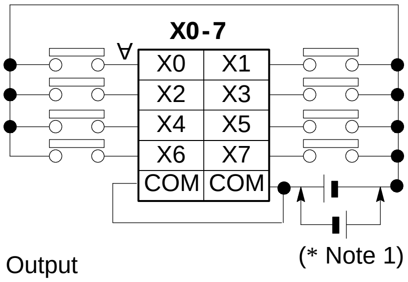


Note

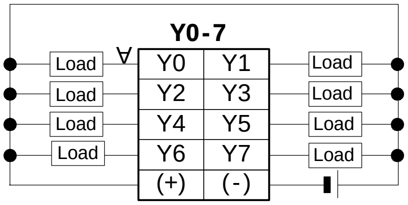
Either positive or negative polarity is possible for the input voltage supply.

2.4.3 C16T/C16CT

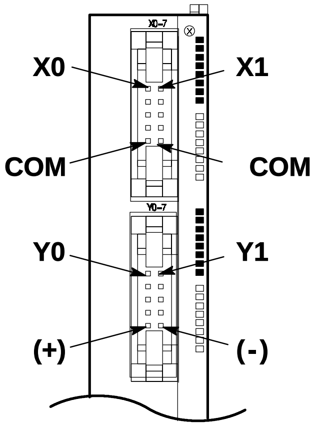
Input



Output



C16T/C16CT



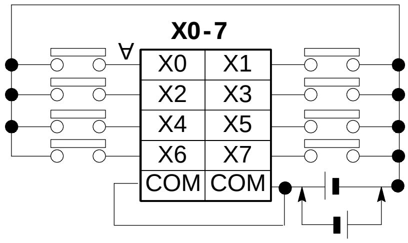
Notes

- **The two COM terminals of input terminal (X0-7) are connected internally, however they should be externally connected as well.**

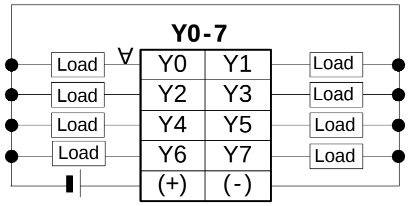
1) Either positive or negative polarity is possible for the input voltage supply.

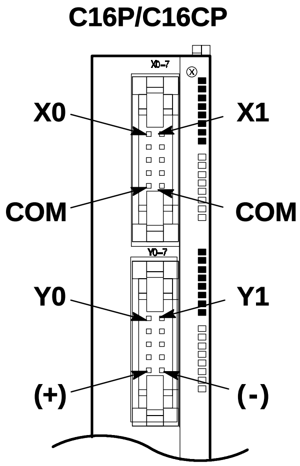
2.4.4 C16P/C16CP

Input



Output



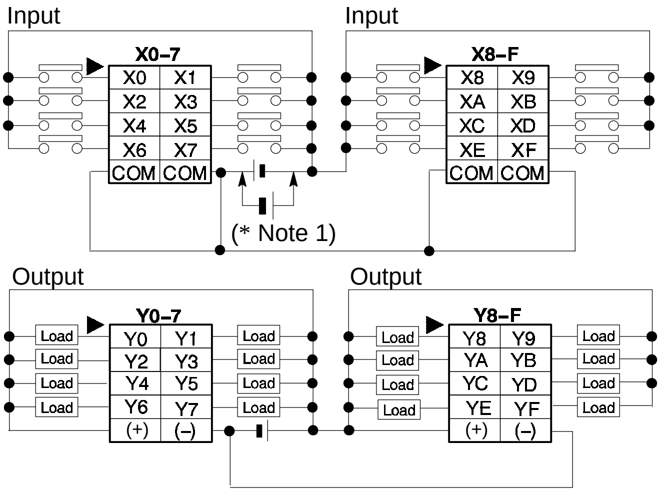


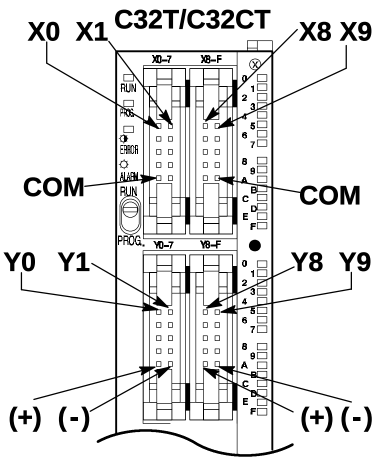
Notes

- **The two COM terminals of input terminal (X0-7) are connected internally, however they should be externally connected as well.**

1) Either positive or negative polarity is possible for the input voltage supply.

2.4.5 C32T/C32CT/T32CT



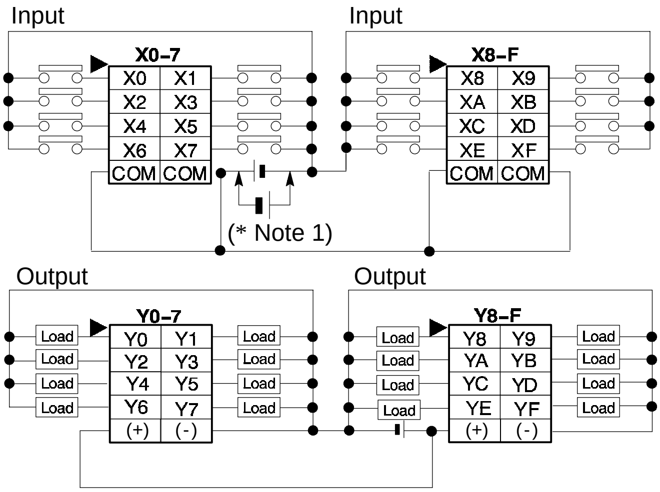


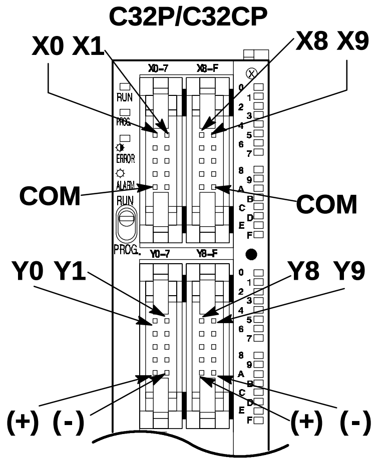
Notes

- The four COM terminals of input terminals (X0-7 and X8-F) are connected internally, however they should be externally connected as well.
- The (+) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.
- The (-) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.

1) Either positive or negative polarity is possible for the input voltage supply.

2.4.6 C32P/C32CP/T32CP





Notes

- The four COM terminals of input terminals (X0-7 and X8-F) are connected internally, however they should be externally connected as well.
- The (+) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.
- The (-) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.

1) Either positive or negative polarity is possible for the input voltage supply.

2.5 Backing Up the 10 K Step Type

Recharging the internal backup battery

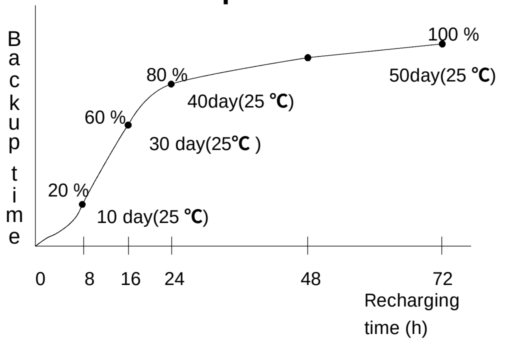
A secondary battery (rechargeable type) is used as the backup battery in the control unit (10 K step type). When shipped, this battery is not charged; therefore, please make sure it is sufficiently charged before using. Recharging is automatic when DC power is supplied.

When backup is possible of operation memory

Relationship between recharging time and backup time

The number of days for the backup time changes with the proportion of recharging time. Please use the graph below to verify the number of days for the backup time.

Relationship between recharging time and backup time



Number of days for backup depending on ambient temperature

The number of days for the backup differs, as shown in the table below, when recharging is done for 72 hours at a certain ambient temperature.

Ambient temperature	Number of days for backup time
70 ℃	Approx. 14 days
25 ℃	Approx. 50 days
−20 ℃	Approx. 25 days

Predicted life of internal backup battery

When the control unit is on (when power is supplied) the internal backup battery life will differ depending on the ambient temperature. Refer to the table below to predict the life of the internal backup battery.

Note: When the control unit is off (when power is not supplied), temperature has almost no effect on the battery life.

Ambient temperature	Internal backup battery life
55 °C	Approx. 430 days (approx. 1 year)
45 °C	Approx. 1,200 days (approx. 3 years)
40 °C	Approx. 2,100 days (approx. 6 years)
35 °C	Approx. 3,300 days (approx. 9 years)
34 °Cand less	Approx. 10 years

Range of backup possible with the internal backup battery

- The range that the user specifies with the programming tool from among the computation memories given below, will become the holding backup area.
  1) Timer/counter (T/C)
  2) Internal relay (R)
  3) Data register (DT)
  4) Step ladder

- If the user does not make a designation, the default setting range will become the backup holding area.
- The clock/calendar timer value is also backed up.
- The program and system registers are held in EEP-ROM with no relation to the internal backup battery.

Handling of the internal backup battery

It is not possible to replace the internal backup battery when it has been exhausted or has exceeded its life span.

Cautions regarding the backup of data

- The clock/calendar timer value is backed up by the secondary battery.
- Begin use only after the secondary battery has been sufficiently charged.

For reference

To read and use the initial settings data when starting operation, you can also write the data to EEPROM by using the F12 EEPROM read instruction and the F13 EEPROM write instruction.

Chapter 3

Expansion I/O Units

☛ next page

3.1 Parts and Terminology

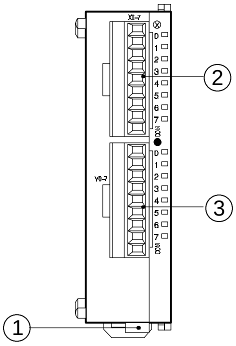
There are fourteen different expansion I/O unit types available:

1. E8RS terminal type
2. E16RS terminal type
3. E8RM connector type
4. E16RM connector type
5. E16T
6. E16P
7. E32T
8. E32P
9. E8X input type
10. E16X input type
11. E8YT output type
12. E8YP output type
13. E16YT output type
14. E16YP output type

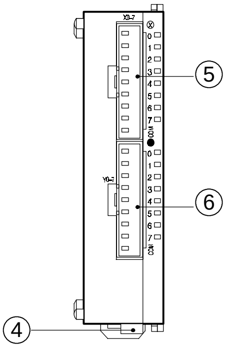
In the next sections you will find a detailed description of each expansion I/O unit.

3.1.1 Expansion I/O Unit Types

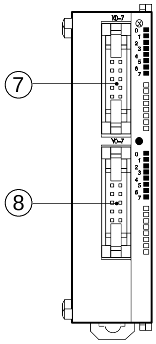
E8RS/E16RS (terminal type)



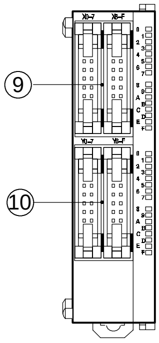
E8RM/E16RM (connector type)



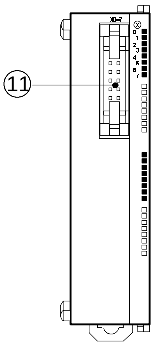
E16T/E16P



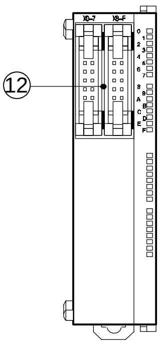
E32T/E32P



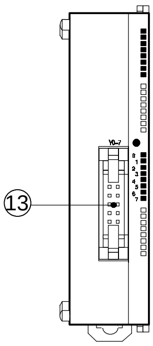
E8X



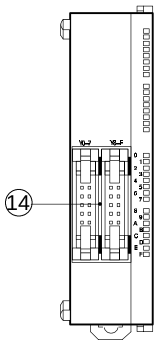
E16X



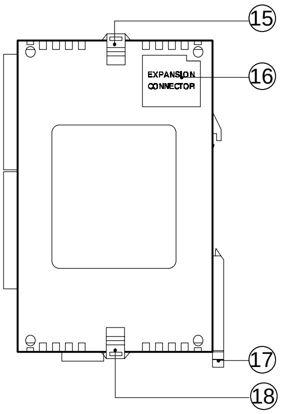
E8YT/E8YP



E16YT/E16YP



All expansion I/O unit types



① ④ Power supply connector

Supply 24 V DC. It is connected using the power supply cable (AFP0581) that comes with the unit.

② Input terminal (9-pin)

③ Output terminal (9-pin)

The input and output terminals (② and ③) use a terminal block socket made by Phoenix Contact Co. (product number: 1840434) (*section 7.6).

⑤ Input connector (9-pin)

⑥ Output connector (9-pin)

The input and output connectors (⑤ and ⑥) use a connector made by Molex Japan Co. (product number: 51067-0900) (*section 7.7).

⑦ ⑪ Input connector (10-pin)

⑧ ⑬ Output connector (10-pin)

⑨ ⑫ Input connector (10-pin × 2)

⑩ ⑭ Output connector (10-pin × 2)

Use a MIL type connector for the input and output connectors (⑦ to ⑭) (*section 7.8).

⑮ ⑱ Expansion hook

is used to secure expansion units.

⑯ Expansion connector

connects an expansion unit to the internal circuit of the expansion I/O unit (*section 6.1).

⑰ DIN rail attachment lever

allows simple attachment to a DIN rail.

The lever is also used for installation on FP0 slim type mounting plate (AFP0803).

3.2 Specifications

3.2.1 General Specifications

For more details on the general specifications, refer to section 2.2.1.

3.2.2 Input Specifications

<table>
<tr><th colspan="2">Item</th><th>Description</th></tr>
<tr><td colspan="2">Insulation method</td><td>optical coupler</td></tr>
<tr><td colspan="2">Rated input voltage</td><td>24 V DC</td></tr>
<tr><td colspan="2">Rated input current</td><td>approx. 4.3 mA (at 24 V DC)</td></tr>
<tr><td colspan="2">Input impedance</td><td>approx. 5.6 kΩ</td></tr>
<tr><td colspan="2">Operating voltage range</td><td>21.6 to 26.4 V DC</td></tr>
<tr><td rowspan="3">Input points per common (* Note)</td><td>E8RS, E8RM</td><td>4 points/common</td></tr>
<tr><td>E16RS, E16RM, E16T, E16P, E8X</td><td>8 points/common</td></tr>
<tr><td>E32T, E32P, E16X</td><td>16 points/common</td></tr>
<tr><td colspan="2">ON voltage/ON current</td><td>19.2 V or less/3 mA or less</td></tr>
<tr><td colspan="2">OFF voltage/OFF current</td><td>2.4 V or more/1 mA or more</td></tr>
<tr><td rowspan="2">Response time (at 24 V DC and 25 °C/66 °F)</td><td>OFF ↔ ON</td><td>2 ms or less</td></tr>
<tr><td>ON ↔ OFF</td><td>the same as above</td></tr>
<tr><td colspan="2">Operating mode indicator</td><td>LED</td></tr>
</table>

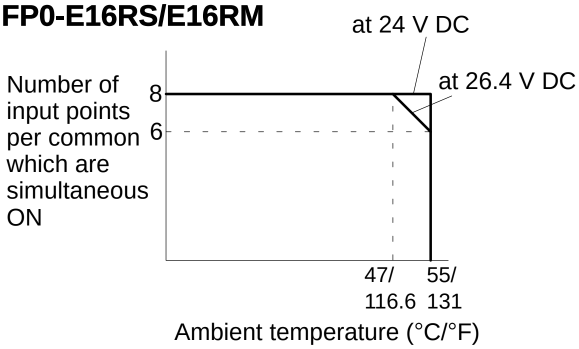
☞ **Note**

Either positive or negative polarity is possible for the input voltage supply.

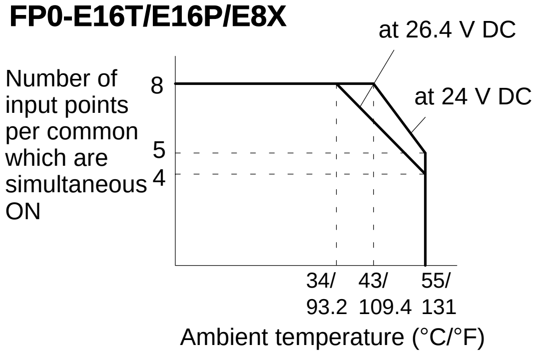
3.2.2.1 Limitations on Number of Simultaneous Input ON Points

Keep the number of input points per common which are simultaneously ON within the following range as determined by the temperature.

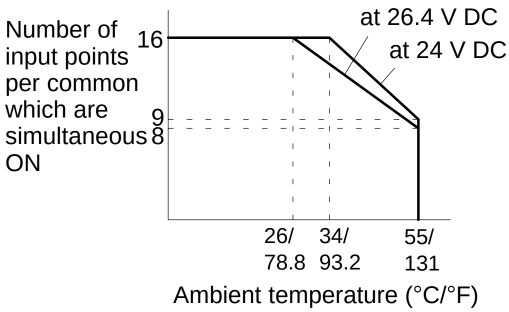
FP0-E16RS/E16RM



FP0-E16T/E16P/E8X



FP0-E32T/E32P/E16X



3.2.3 Output Specifications

3.2.3.1 Relay Output Type

FP0 relay output types: E8RS, E8RM, E16RS, and E16RM

Item		Description
Output type		Normally open (1 Form A) relay output
Rated control capacity		2 A 250 V AC, 2 A 30 V DC (4.5 A maximum per common) (at Resistance load)
Output points per common	**E8RS, E8RM**	4 points/common
	E16RS, E16RM	8 points/common
Response time	**OFF ↔ ON**	approx. 10 ms
	ON ↔ OFF	approx. 8 ms
Mechanical life time		20,000,000 operations or more
Electrical life time		100,000 operations or more
Surge absorber		None
Operating mode indicator		LED

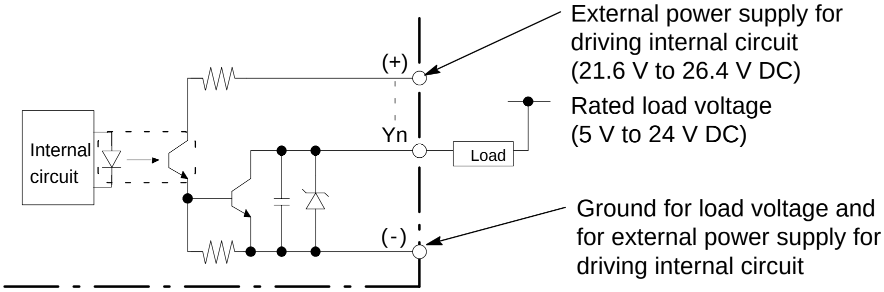
3.2.3.2 Transistor Output Type

FP0 transistor output types: E16T, E16P, E32T, E32P, E8YT, E8YP, E16YT, E16YP

Item		Description
Insulation method		optical coupler
Output type		open collector
Rated load voltage		NPN open collector type: 5 to 24 V DC (* Note) PNP open collector type: 24 V DC
Operating load voltage range		NPN open collector type: 4.75 to 26.4 V DC PNP open collector type: 21.6 to 26.4 V DC
Max. load current		0.1 A
Max. surge current		0.3 A
Output points per common	**E16T, E16P, E8YT, E8YP**	8 points/common
	E32T, E32P, E16YT, E16YP	16 points/common
OFF state leakage current		100 μA or less
ON state voltage drop		1.5 V or less
External power supply for driving internal circuit	**Voltage**	21.6 to 26.4 V DC
	Current	Y0 and Y1: 5 mA/1 point, except Y0 and Y1: 3 mA/1 point
Response time	**OFF → ON**	1 ms or less (Y0 and Y1 only: 50 μs or less)
	ON → OFF	1 ms or less (Y0 and Y1 only: 50 μs or less)
Surge absorber		Zener diode
Operating mode indicator		LED

☞ **Note**

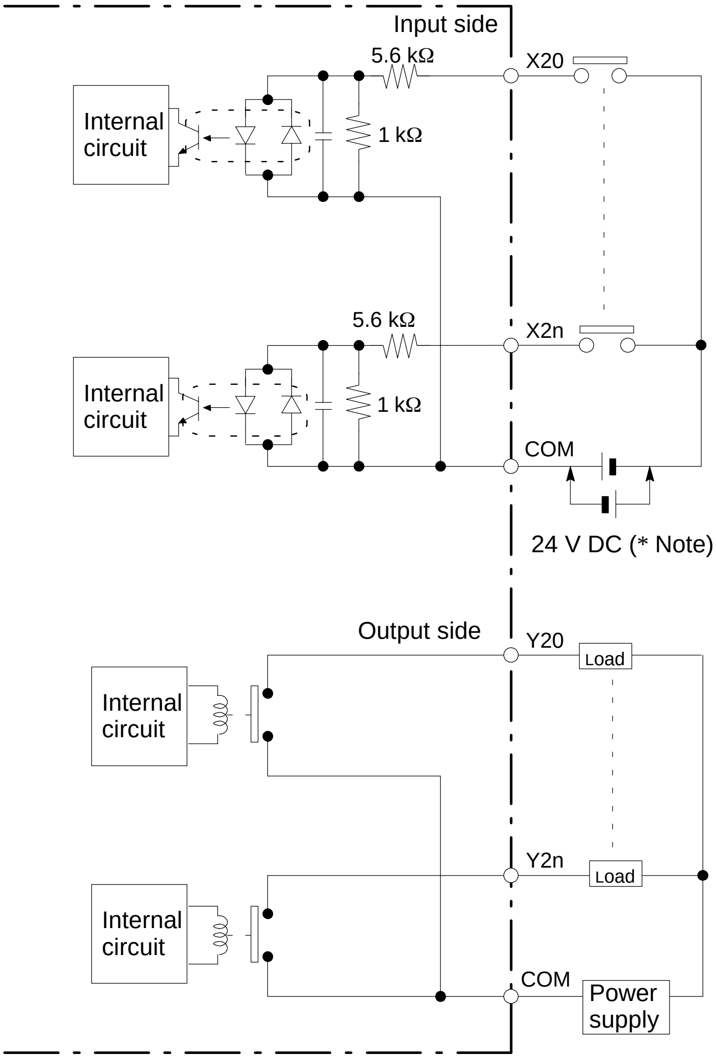
For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.



3.3 Internal Circuit Diagram

3.3.1 Relay Output Type (E8RS/E8RM/E16RS/E16RM)

FP0-E8RS/E8RM/E16RS/E16RM



Notes

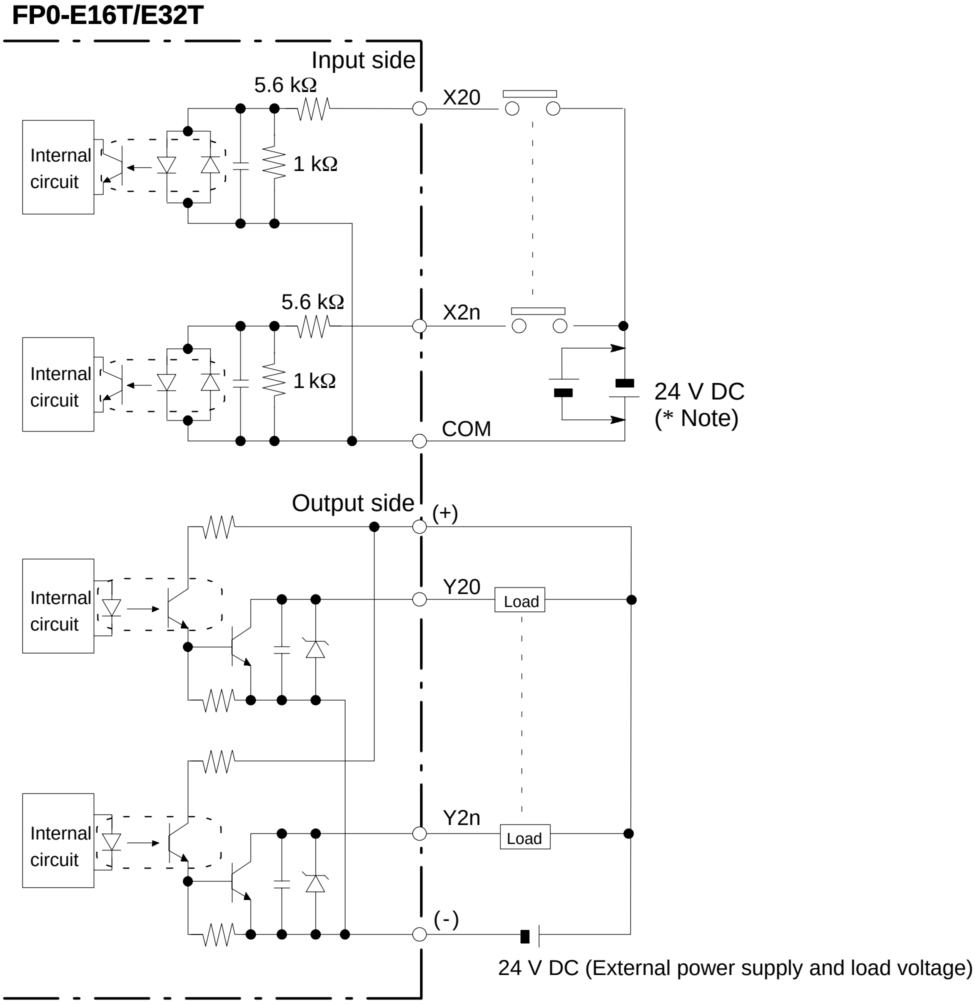
- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (*section 5.3).**

3.3.2 Transistor Output Type

3.3.2.1 NPN Open Collector Type (E16T/E32T)

When the load voltage and external power supply are the same

This example is when the values of the rated load voltage and external power supply for driving internal circuit are the same. In this situation, there is only one power supply.



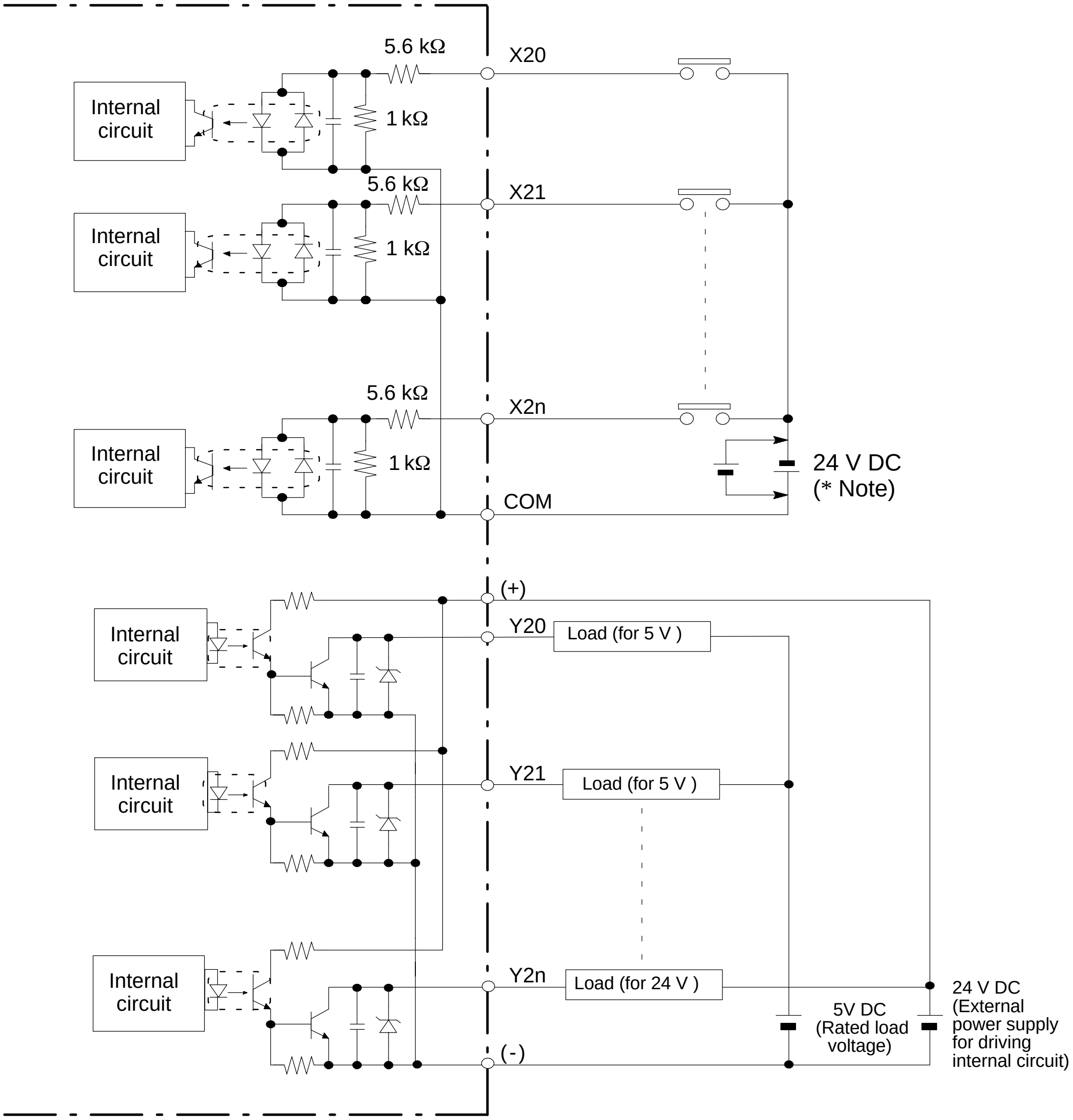
Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (*section 5.3).**

When the load voltage differs from the 24 V DC external power supply for the driving the internal circuit

Other than 24 V DC load voltage, 5 V DC and 12 V DC and other load voltages can be connected.

FP0-E16T/E32T

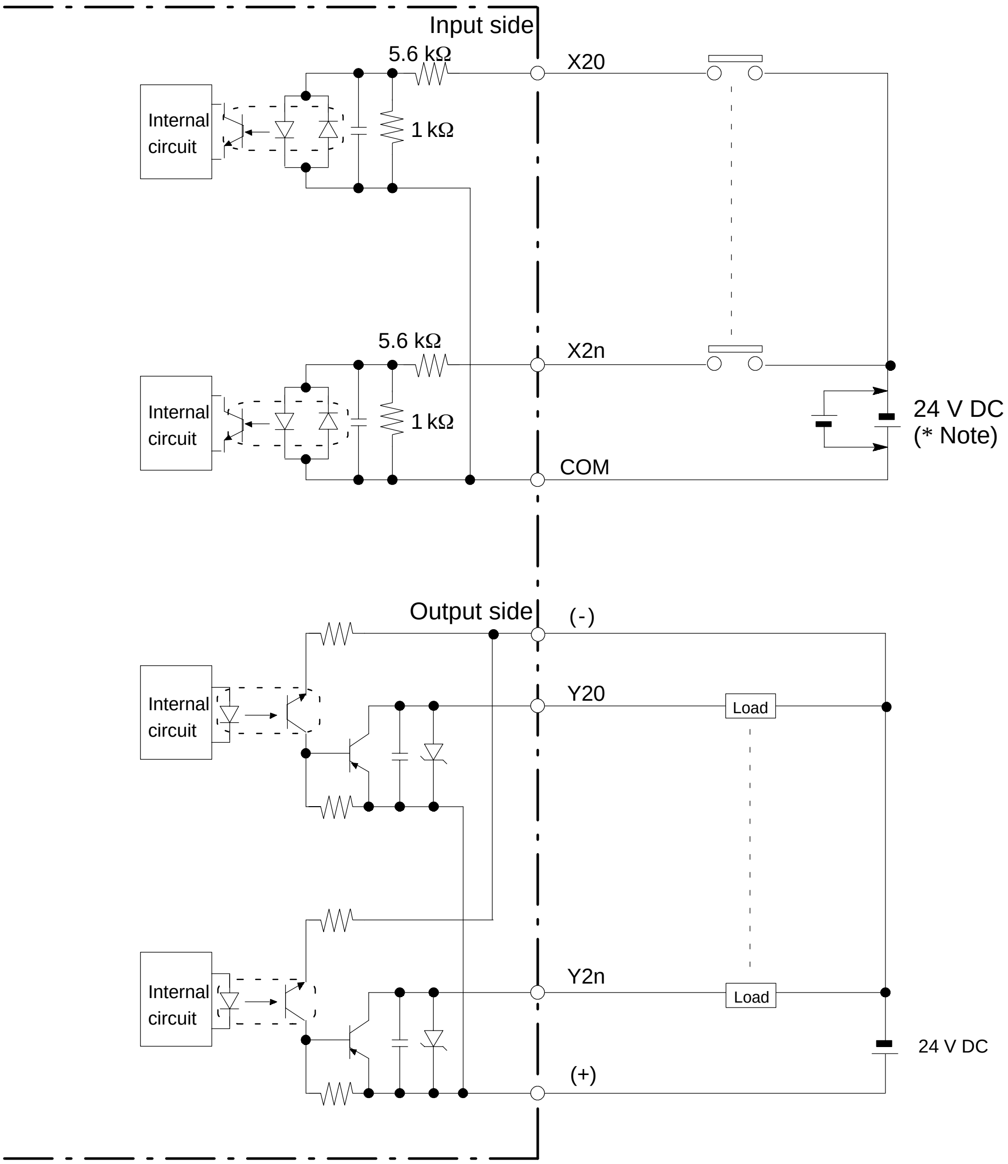


Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (*section 5.3).**

3.3.2.2 PNP Open Collector Type (E16P/E32P)

FP0-E16P/E32P

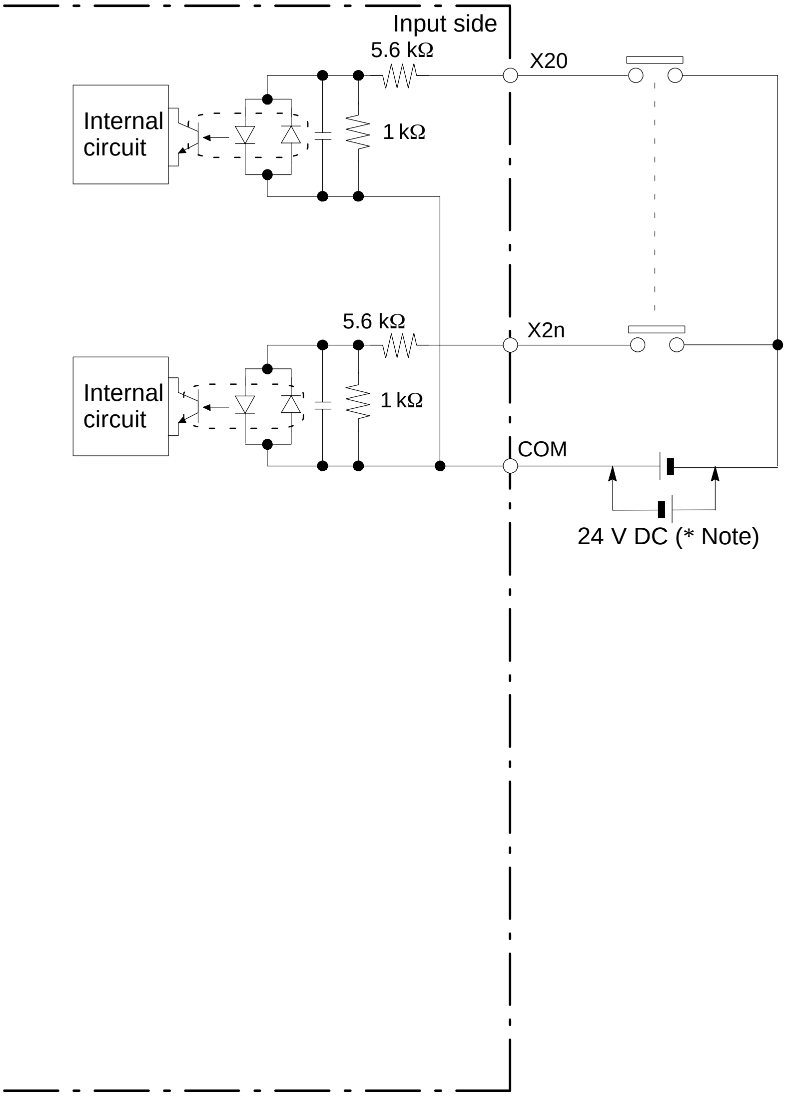


Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (*section 5.3).**

3.3.3 Expansion Input Units (E8X/E16X)

FP0-E8X/E16X



Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The input number given above is the input number when the expansion input unit is installed as the first expansion unit (*section 5.3).**

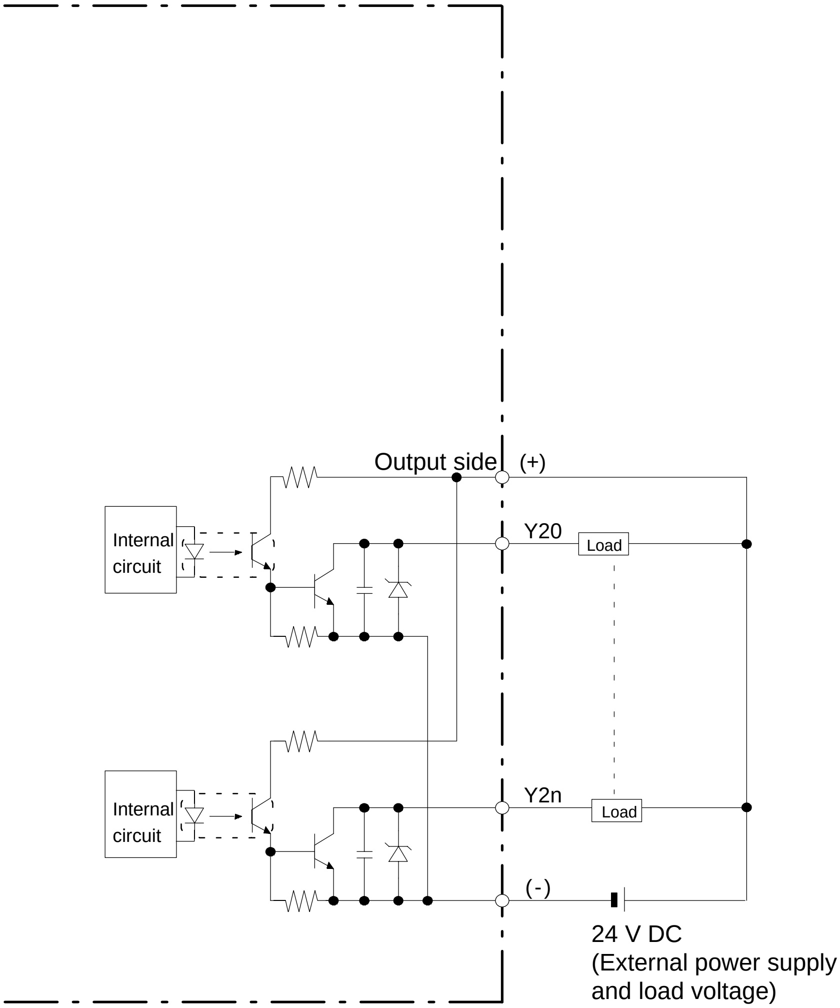
3.3.4 Expansion Output Units

3.3.4.1 NPN Open Collector Type (E8YT/E16YT)

When the load voltage and external power supply are the same

This example is when the values of the rated load voltage and external power supply for driving the internal circuit are the same. In this situation, there is only one power supply.

FP0-E8YT/E16YT



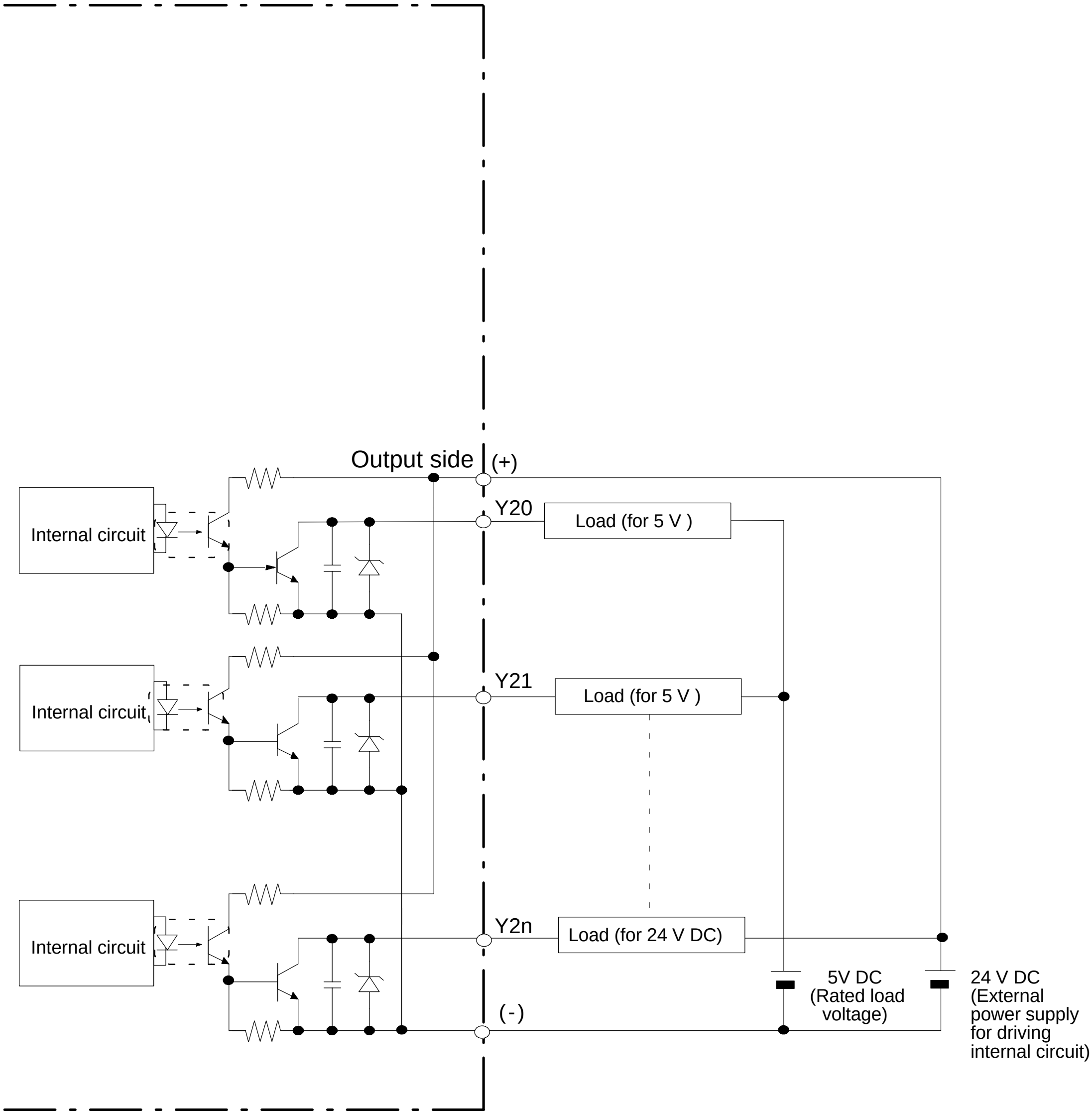
Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (*section 5.3).

When the load voltage differs from the 24 V DC external power supply for the driving the internal circuit

Other than 24 V DC load voltage, 5 V DC and 12 V DC and other load voltages can be connected.

FP0-E8YT/E16YT

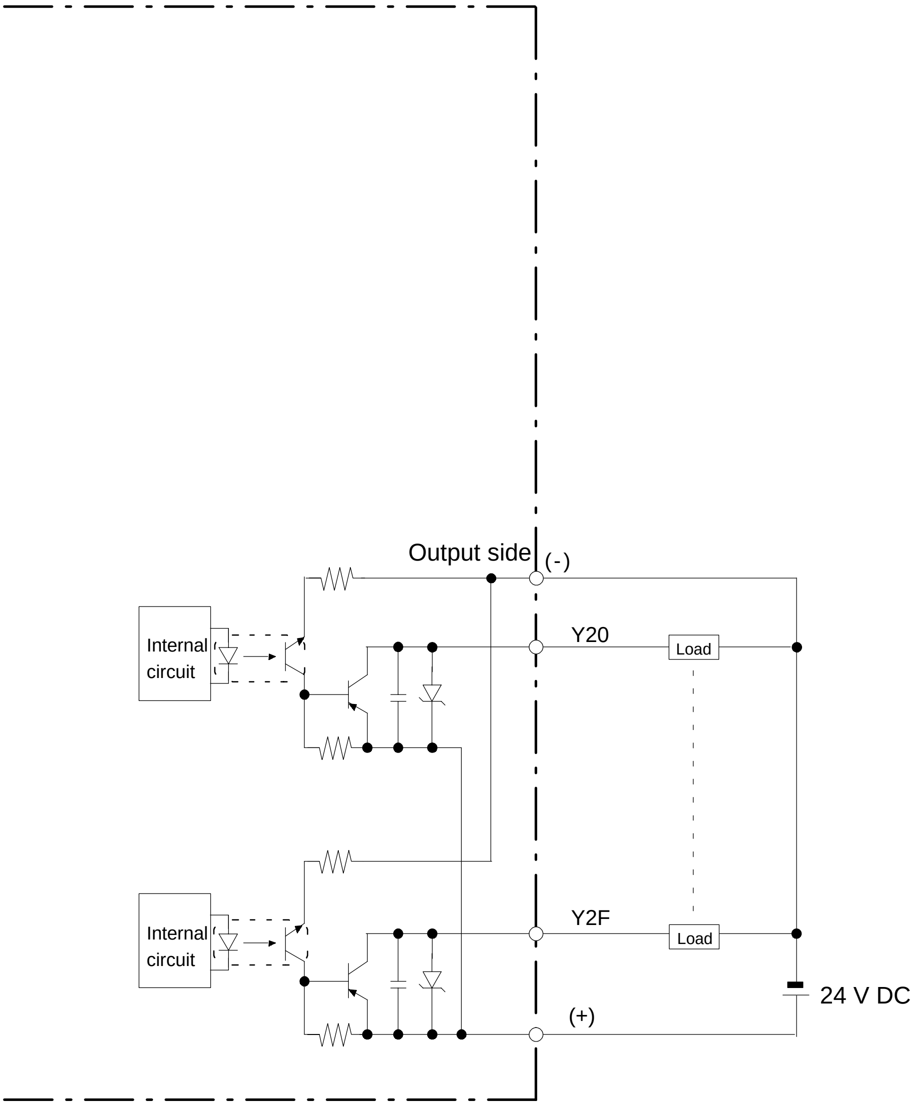


Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (*section 5.3).

3.3.4.2 PNP Open Collector Type (E8YP/E16YP)

FP0-E8YP/E16YP

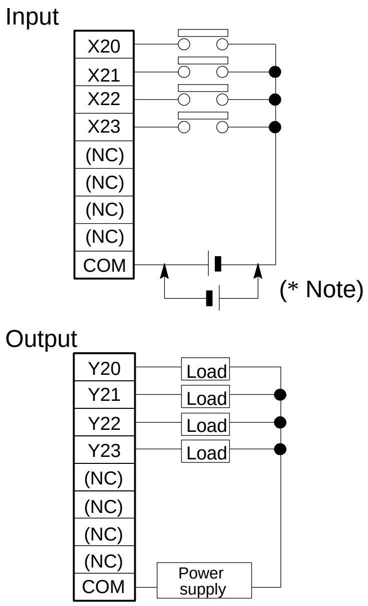


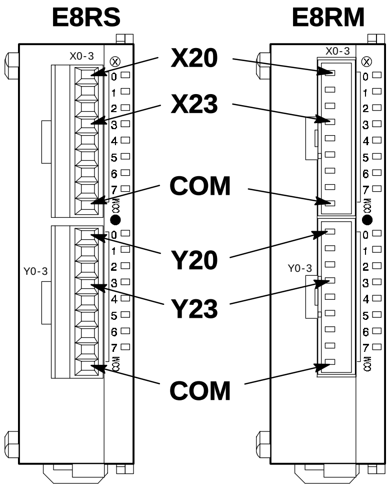
Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (*section 5.3).

3.4 Pin Layouts

3.4.1 E8RS/E8RM

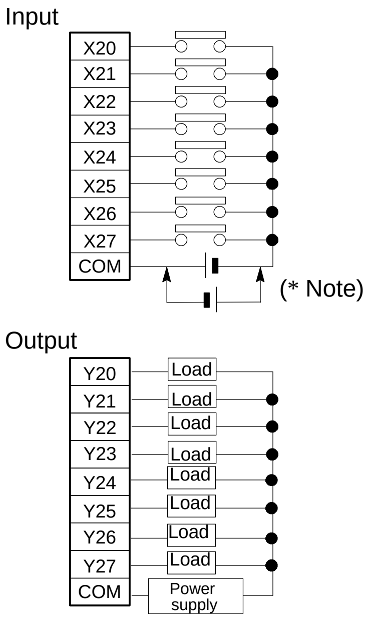


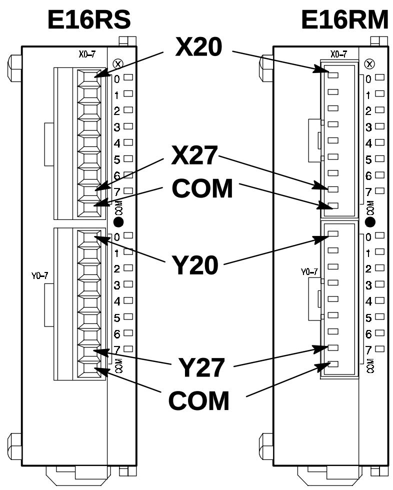


Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.2 E16RS/E16RM

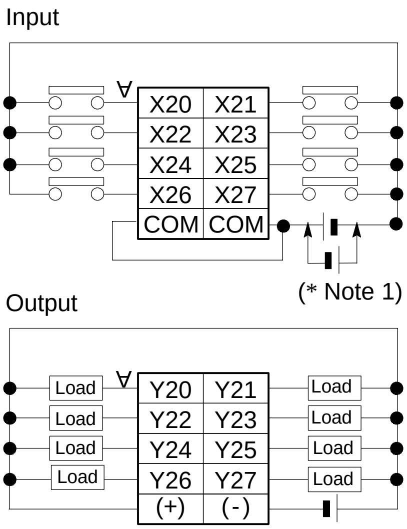


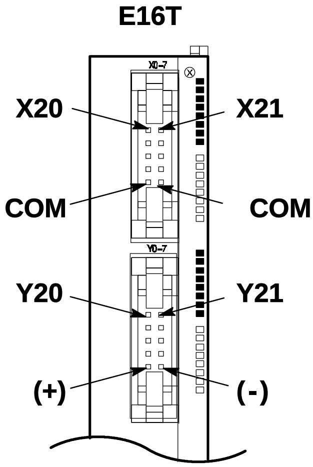


Notes

- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.3 E16T





Notes

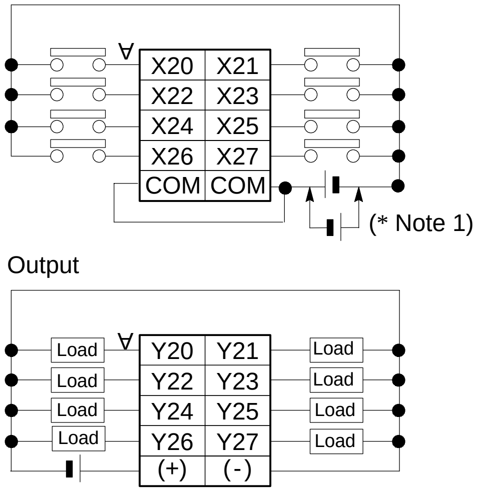
- **The two COM terminals of input terminals are connected internally, however they should be externally connected as well.**

1) **Either positive or negative polarity is possible for the input voltage supply.**

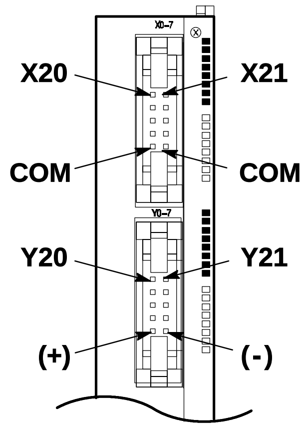
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.4 E16P

Input



E16P



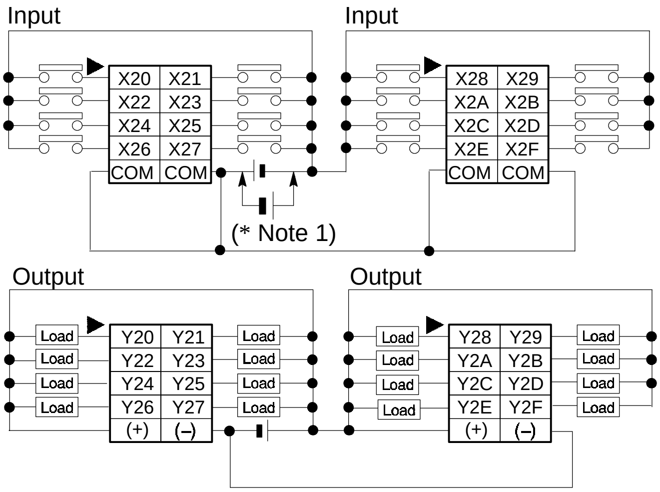
Notes

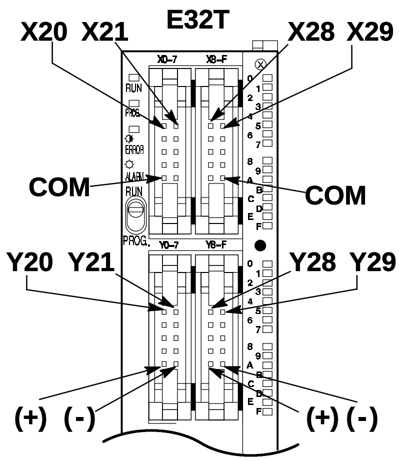
- **The two COM terminals of input terminals are connected internally, however they should be externally connected as well.**

1) Either positive or negative polarity is possible for the input voltage supply.

- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.5 E32T





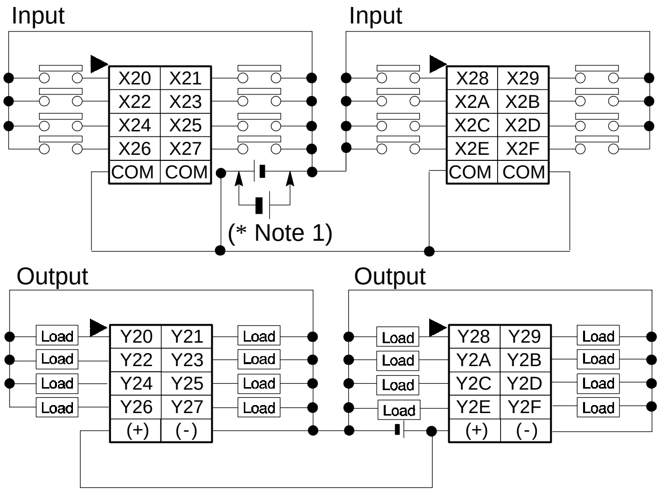
Notes

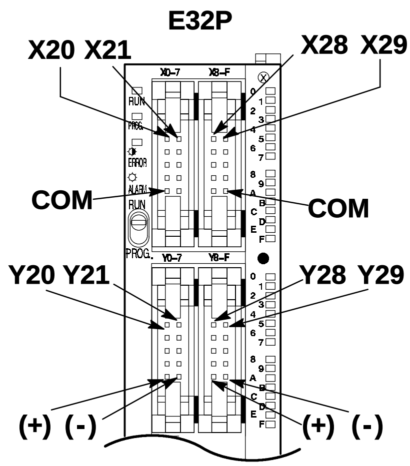
- **The four COM terminals of input terminals are connected internally, however they should be externally connected as well.**
- **The two (+) terminals of output terminals are connected internally, however they should be externally connected as well.**
- **The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.**

1) Either positive or negative polarity is possible for the input voltage supply.

- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.6 E32P





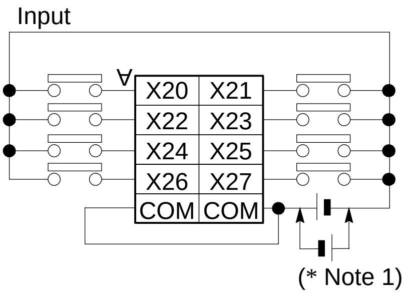
Notes

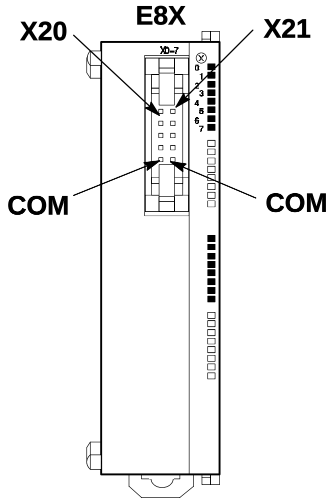
- **The four COM terminals of input terminals are connected internally, however they should be externally connected as well.**
- **The two (+) terminals of output terminals are connected internally, however they should be externally connected as well.**
- **The two (-) terminals of the output terminals are internally connected, however they should be externally connected as well.**

1) Either positive or negative polarity is possible for the input voltage supply.

- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (*section 5.3).**

3.4.7 E8X





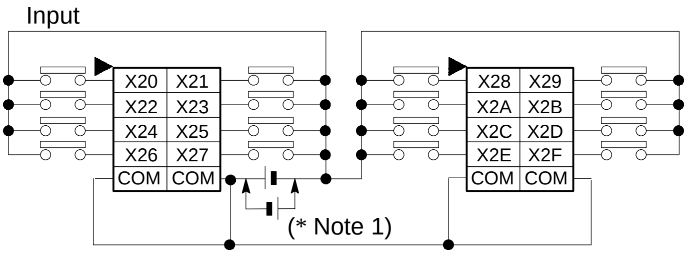
Notes

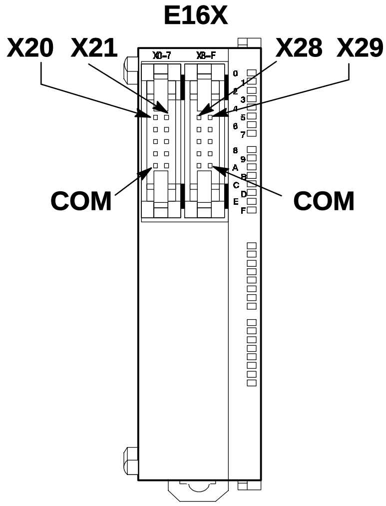
- **The two COM terminals of input terminals are connected internally, however they should be externally connected as well.**

1) **Either positive or negative polarity is possible for the input voltage supply.**

- **The input number given above is the input number when the expansion input unit is installed as the first expansion unit. The input numbers for the expansion input units will differ depending on the location where they are installed (*section 5.3).**

3.4.8 E16X





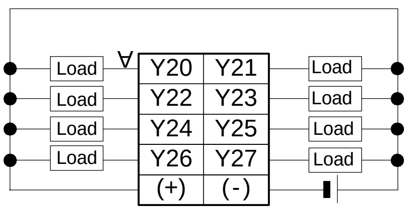
Notes

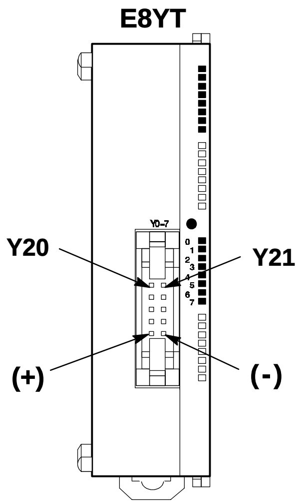
- The four COM terminals of input terminals are connected internally, however they should be externally connected as well.

1) Either positive or negative polarity is possible for the input voltage supply.

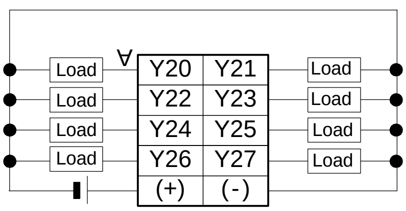
- The input number given above is the input number when the expansion input unit is installed as the first expansion unit. The input numbers for the expansion input units will differ depending on the location where they are installed (*section 5.3).

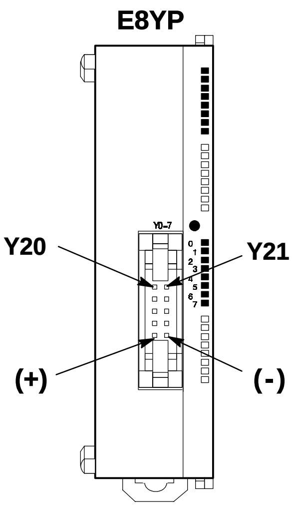
3.4.9 E8YT





3.4.10 E8YP

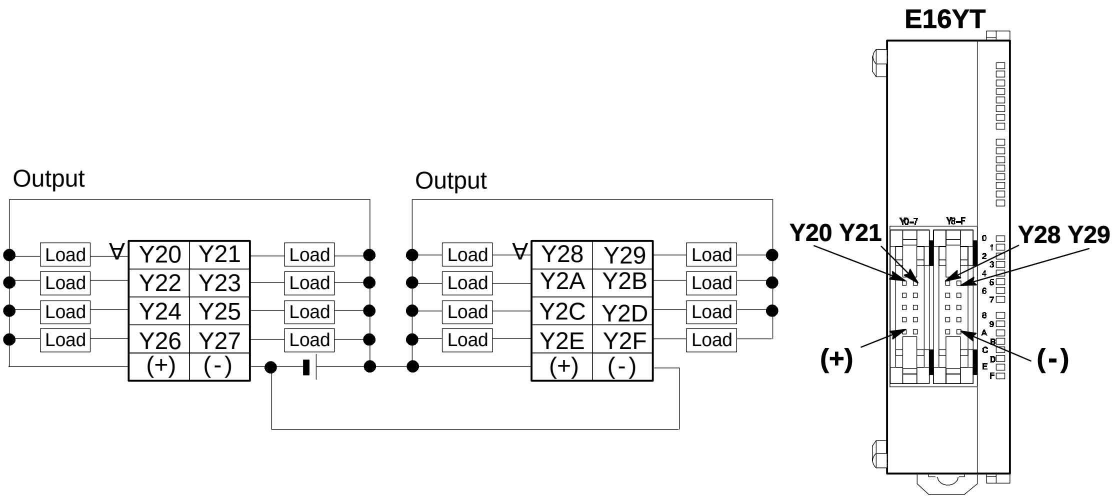




Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (*section 5.3).

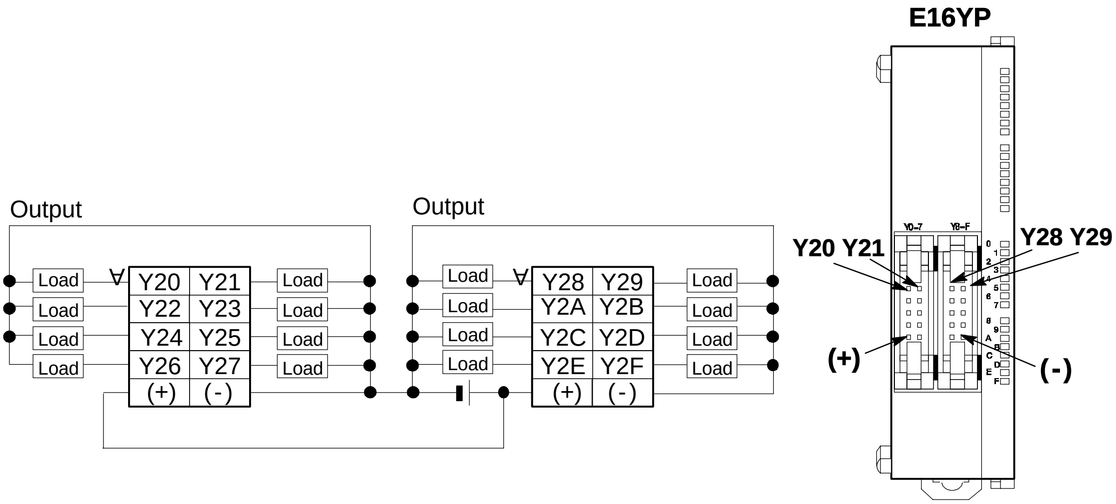
3.4.11 E16YT



Notes

- **The two (+) terminals of the output terminals are connected internally, however they should be externally connected as well.**
- **The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.**
- **The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (*section 5.3).**

3.4.12 E16YP



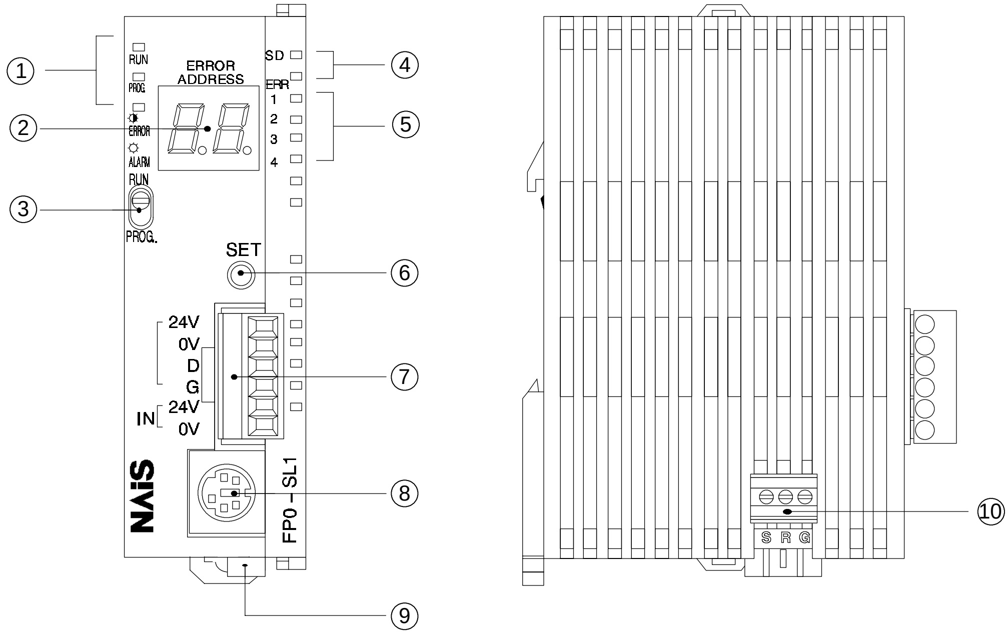
Notes

- **The two (+) terminals of the output terminals are connected internally, however they should be externally connected as well.**
- **The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.**
- **The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (*section 5.3).**

Chapter 4

S-LINK Control Unit

4.1 Names and Functions



① **Status indicator LED**
The LED display the operation mode and error statuses.

② **ERROR ADDRESS display (2-digit hexadecimal display)**
The address at which the S-LINK system error occurred is displayed.

③ **Mode switch**
The mode switch changes the operation mode.

④ **Transmission indicator (SEND)**
This flashes when input or output data is transmitted between the various units of the S-LINK system.

⑤ **ERROR indicators**
These light if an error occurs in the S-LINK system.
ERR1 (Error 1): Short circuit between D - G line.
ERR2: Unused
ERR3 (Error 3): Abnormal voltage level between D - G line.
ERR4 (Error 4): Broken wire or S-LINK I/O device error

⑥ **System SET button**
Pressing the system SET button reads the connection status for the S-LINK system and stores it in the memory. In subsequent operation, the S-LINK unit checks for errors using the connection status registered at this time.
The output unit data effective at the time that the system SET button was pressed is retained.

☛ next page

⑦ **S-LINK terminal block (6-pin)**
The power supply and signal wires of the S-LINK system are connected to the S-LINK terminal block.
The S-LINK terminal block can be detached from the FP0 S-LINK control unit for wiring operations.
For detailed information, refer to section “4.3.2 Wiring to S-LINK Terminal Block.”

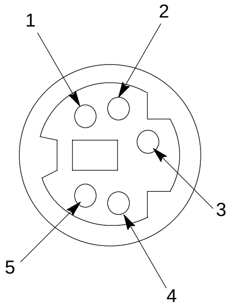
⑧ **Tool port (RS232C)**
The tool port (RS232C) is used to connect a programming tool.

⑨ **Power supply connector**
Supply 24V DC to the power supply connector. It is connected using the power supply cable (AFP0581) that comes with the unit.

⑩ **RS232C port**
Use this port to connect to devices with an RS232C port, such as an I.O.P., a bar code reader, or an image checker, enabling data input and output.

Tool port (RS232C) specifications

Pin assignment



Pin no.	Abbreviation
1	—
2	SD (TXD)
3	SG
4	RD (RXD)
5	+ 5 V

Settings when shipped from the factory

Default value	Baud rate: 9600bps Character bit: 8bits Parity check: Odd Stop bit: 1bit

4.2 Specifications

4.2.1 General Specifications

Item	Description
Rated operating voltage	24V DC
Operating voltage range	21.6V to 26.4V DC
Rated current consumption	150mA or less
Allowed momentary power off time	10ms at 21.6V, 10ms at 24V
Ambient temperature	0°C to +55°C/32°F to +131°F
Storage temperature	-20°C to +70°C/-4°F to +158°F
Ambient humidity	30% to 85% RH (non-condensing)
Storage humidity	30% to 85% RH (non-condensing)
Breakdown voltage	500V AC for 1 minute between S-LINK terminal block and power supply/ ground terminals
Insulation resistance	min. 100MΩ (measured with a 500V DC megger) between S-LINK terminal block and power supply/ground terminals
Vibration resistance	10Hz to 55Hz, 1 cycle/min: double amplitude of 0.75mm/ 0.030in., 10 min on 3 axes
Shock resistance	Shock of 98m/s^2 or more, 4 times on 3 axes
Noise immunity	1,000 Vp-p with pulse widths 50ns and 1µs (based on in-house measurements)
Operating condition	Free from corrosive gases and excessive dust

4.2.2 S-LINK Controller Specifications

Item		Description
Rated power supply voltage		24V DC +/-10% / Allowable ripple p - p +/-10% max. (Supplied from IN - 24V, IN - 0V of the S-LINK terminal block)
Current consumption (* note 1)		[S-LINK controller current consumption (including D - G line current consumption)] 24V DC 1.6A max.
		[Maximum current which can be supplied (supplied to S-LINK unit and I/O devices from 24V - 0V line)] + 24V DC 5A (fuse: 5A)
Transmission method		Bi-directional time-divided multiple signal transmission
Synchronization method		Bit synchronization, frame synchronization
Transmission protocol		S-LINK protocol
Transmission speed		28.5kbps
Transmission delay time		Max. 10.7ms
Transmission distance		Main signal wire: up to a distance to 200m max. (400m when a booster is used)
FAN-out (* note 2)		320
Connection method (* note 3)		'T'-branch multi-drop wiring
No. of input/output points		64 points input/64 points output Fixed
Display indicators	**Transmission display (SEND)**	Green LED blinks in response to synchronization signals
	Error indicator	Red LED light up depending on the error
	Error address display	If the system error occurs, the error address is displayed using the red 7-segment LED.

Notes

1) **For detailed information on current consumption, refer to "Determining the Power Supply" in the "S-LINK Design Manual."**

2) **The output capacitance for the D-G line of the S-LINK controller and booster is indicated by FAN-out, and the input capacitance from the D-G line of the S-LINK configuration unit is indicated by FAN-in. When configuring the S-LINK system, the configuration should be set up so that the FAN-out total > or = the FAN-in total. (For detailed information on calculating the FAN-in value and other values, see the "S-LINK Design Manual."**

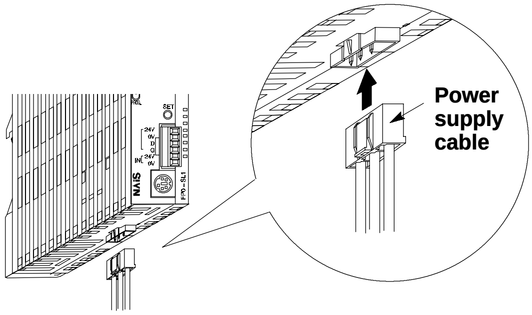
3) **The FP0 S-LINK control unit does not have a loop wiring function.**

4.3 Wiring the Power Supply

With the FP0 S-LINK control unit, power must be supplied at two locations (power supply connector and S-LINK terminal block).

4.3.1 Wiring to Power Supply Connector

This is the power supply for the programmable controller section and the S-LINK controller in the S-LINK control unit (24V DC, 150mA).

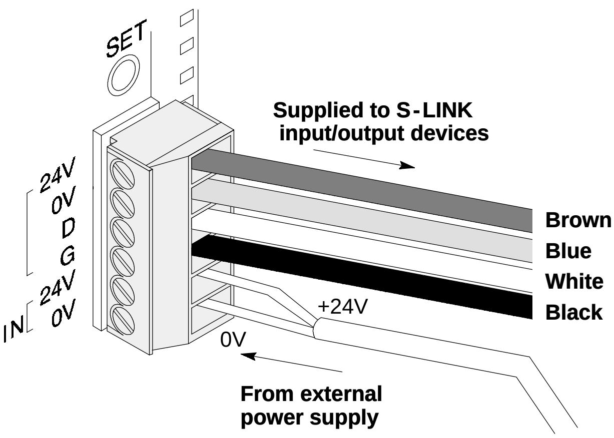


4.3.2 Wiring to S-LINK Terminal Block

This is the power supply for the S-LINK controller in the S-LINK control unit and other S-LINK input/output devices to which power is supplied through the 24V - 0V line of the S-LINK main cable.

The current consumption for the overall S-LINK system is calculated by referring to the section entitled "Determining the Power Supply" in the "S-LINK Design Manual." (For standard purposes, a power supply exceeding 24V DC, 1.6 A should be selected.)

Supply of power to S-LINK terminal block



☛ next page

S-LINK terminal block: MC1.5/6-ST-3.5 (Made by Phoenix Contact Co.)

Terminal name	Color of connecting cable	Description
24V	Brown	Main wire (for S-LINK I/O devices)
0V	Blue	
D	White	
G	Black	
IN-24V	—	External power supply input for S-LINK
IN-0V	—	

Suitable wires (twisted wire)

Size	AWG#20 to 16
Normal cross-section surface area	0.5 to 1.25mm^2

☞ Notes

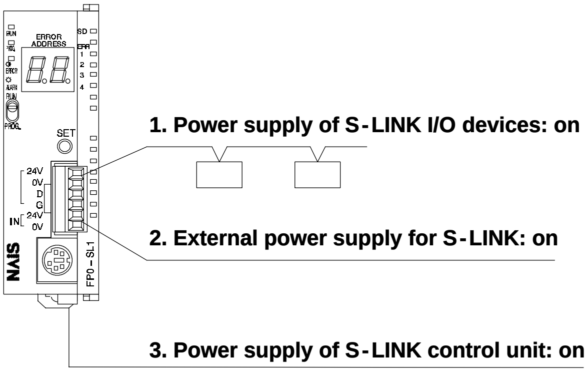
- **The S-LINK section is protected by a fuse, but if too many input/output devices are connected, or if the current consumption is heavy enough to cause the fuse to blow, we recommend providing a local power supply.**
- **A short-circuit between D-G, or between D-24V, triggers the protective circuit, but there is no protection against short-circuiting between G-24V or 0V-24V. Be aware that a short-circuit can cause a breakdown or malfunction.**

4.4 Sequence of Turning on Power Supplies

When turning on the power supplies to the S-LINK control unit, follow the sequence outlined below.

Procedure:

1. **Turn on the power supply to the S-LINK I/O devices connected to the S-LINK system.**
2. **Turn on the external power supply to the S-LINK.**
3. **Last, turn on the power supply to the S-LINK control unit itself.**



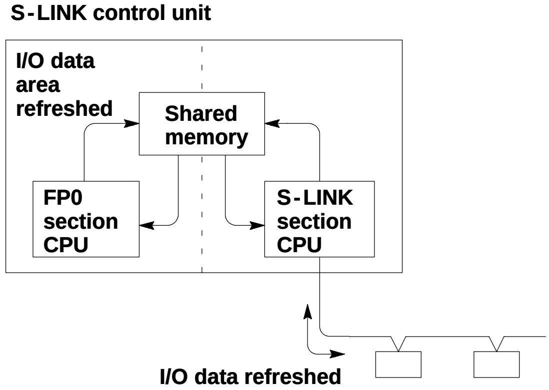
If using the power supply of booster, start up the booster before the external power supply for S-LINK.

When turning off the power supplies, reverse the order of the sequence noted above.

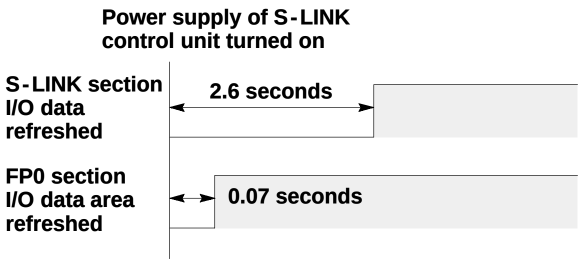
4.5 Operation When Power Supply is Turned On

Refreshing S-LINK I/O data

With the S-LINK control unit, I/O data is refreshed by the CPUs of both the FP0 section and the S-LINK section, through the memory shared between them.



The illustration below shows the time required until the first refreshing is completed by the S-LINK control unit after the power supply has been turned on. (The external power supply for the S-LINK is already on.)



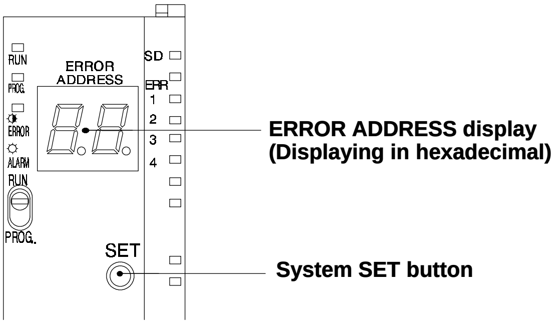
When the power supply to the S-LINK control unit is turned on, it takes approximately 2.6 seconds for the S-LINK I/O data to be verified by the FP0 section. Be particularly careful with regard to the FP0 sequence program, if using the S-LINK input at the b contact relay when the power supply is turned on.

4.6 S-LINK System Address Recognition

4.6.1 Recognizing the Address

Before the S-LINK system is being operated for the first time, turn on the power supply and then press the system SET button.

When the system SET button is pressed, the number of connected devices recognized by S-LINK control unit blinks on the error address display in hexadecimal.



If the actual number of connected devices differs from the number displayed, since an unrecognized S-LINK device exists, check for address overlapping, improper connection, etc..

Subsequently, an error check is carried out based on this status. When an address is recognized, that status is stored in the EEPROM, so it is not necessary to press the system SET button after that point (each time the power supply is turned on).

When the power supply is switched on for the first time after completing the S-LINK system wiring, an arbitrary error display may appear. This does not indicate any abnormal operation. If the system SET button is pressed, this display is erased.

If an error address is displayed during operation, confirm the address, and then turn off the power supply, correct the address at the location where the error occurred, and turn the power supply on again. Check to make sure the error address display has disappeared. (Do not press the system SET button in this case.)

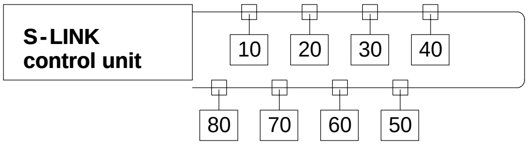
If the system SET button is pressed after an error has occurred and before it is canceled, the error will be canceled. If the cause of the error has not been corrected at that point, however, be aware that the I/O device for that address will be skipped during any subsequent checks.

Note

If the system SET button is pressed without recovery having been made, that status will be recognized for that address, and any locations where recovery has not been made will not be recognized.

4.6.2 Address Setting of S-LINK I/O Device

Addresses can be set freely, regardless of the position of the I/O device connected to the system, but problems in the wiring of the main cable, such as broken or disconnected wires, can be detected more easily if I/O devices closer to the S-LINK control unit are given smaller addresses, and addresses increase in sequential order for I/O devices which are farther away from the S-LINK control unit.



Numeric values indicate the initial address for each I/O device.

Up to two I/O devices can be assigned the same address within the system for any individual S-LINK control unit. Do not set the same address for three or more I/O devices.

Up to seven boosters can be connected to one system for any individual S-LINK control unit, but the actual number which can be connected varies depending on the units configuring the system and the wiring length.

☞ **Note**

The FP0 S-LINK control unit does not have a loop wiring function.

4.7 Judging Errors from the Error Indicators

If an error occurs in the S-LINK system, the ERROR indicator indicated in the table below lights, depending on the content of the error.

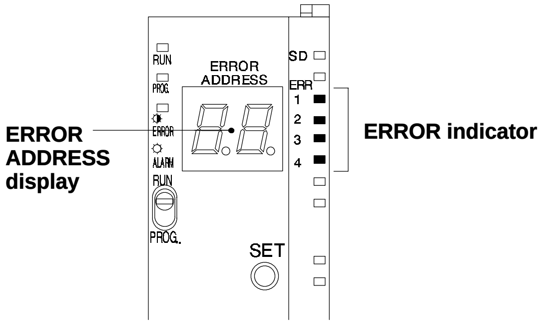
ERROR indicators				**Description**	**Steps to take**
ERR1	**ERR2**	**ERR3**	**ERR4**		
on	**off**	**on**	**off**	Short-circuit between D-G ☛ note 1	If the ERR1 or ERR3 indicator lights, output of the signal being transmitted stops, and none of the S-LINK devices connected to the system will operate. Also, if a short-circuit occurs at a location far away, there may be times when ERR1 does not light. Check the S-LINK signal/power line.
off	**off**	**on**	**off**	Error in level of signal being transmitted	There is a possibility that the wiring length, the configuration, or the number of configuration devices connected to the system exceeds the rated limit. Check the system configuration once again.
off	**off**	**off**	**on**	Address has been changed/ D or G line is broken or disconnected/ Error in S-LINK unit for displayed address ☛ note 2	Check to see if the S-LINK signal/power line is broken or disconnected, or if the address is incorrect. In this case, transmission signals are being output, so the S-LINK input/output devices operate normally.

☞ Notes

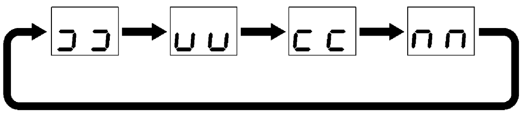
1) **This ERROR indicator lights even if the external power supply to the S-LINK has not been turned on, but this does not indicate a breakdown in the S-LINK control unit itself. Check the external power supply to the S-LINK.**
2) **ERR4 is held, so to cancel it, one of the following is required: turn the power supply to the FP0 off and then on again, press the system SET button and enter the settings again, or turn the power supply on the S-LINK side off and then on again.**

4.8 Judging Errors Address Displays

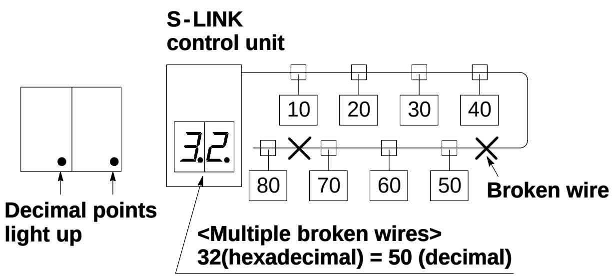
The transmission line is monitored at all times, and if an error occurs, the address at which the error occurred is displayed as a hexadecimal value.



During normal transmission:
The “コ コ” shaped charactor rotates in the clockwise direction.



If an error occurs:
The address is displayed. In case faults occur at several locations, the smallest error address is displayed and the decimal points light up simultaneously.



Chapter 5

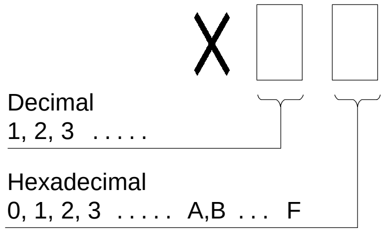
I/O Allocation

5.1 I/O Number

Expression of numbers for input/output relays

Since input relay (X) and output relay (Y) are handled in units of 16 points, they are expressed as a combination of decimal and hexadecimal numbers as shown below.

<Example> External input relay (X)



X0, X1 . . . . XF
X10, X11 . . . . X1F
X20, X21 . . . . X2F
⋮ ⋮ ⋮

Specifying X and Y numbers

On the FP0, the same numbers are used for input and output.
Example: The same number “X20 and Y20” can be used for input and output

5.2 Control Unit

The I/O allocation of the FP0 control unit is fixed.

Type		I/O number
C10RS, C10CRS, C10RM, C10CRM	**Input: 6 points**	X0 to X5
	Output: 4 points	Y0 to Y3
C14RS, C14CRS, C14RM, C14CRM	**Input: 8 points**	X0 to X7
	Output: 6 points	Y0 to Y5
C16T, C16CT, C16P, C16CP	**Input: 8 points**	X0 to X7
	Output: 8 points	Y0 to Y7
C32T, C32CT, C32P, C32CP , T32CT, T32CP	**Input: 16 points**	X0 to XF
	Output: 16 points	Y0 to YF

S-LINK Control Unit

The I/O allocation of the S-LINK control unit is fixed.

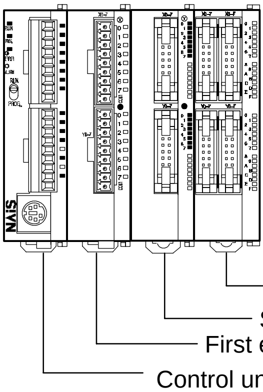
Unit	FP0 I/O	S-LINK address
Input: 64 points	X80 to X8F	0 to 15
	X90 to X9F	16 to 31
	X100 to X10F	32 to 47
	X110 to X11F	48 to 63
Output: 64 points	Y80 to Y8F	64 to 79
	Y90 to Y9F	80 to 95
	Y100 to Y10F	96 to 111
	Y110 to Y11F	112 to 127

5.3 Expansion I/O Unit

Up to three expansion I/O units can be added.

I/O numbers do not need to be set as I/O allocation is performed automatically by the FP0 control unit when an expansion I/O unit is added.

The I/O allocation of expansion I/O unit is determined by the installation location.



Type		I/O number		
		First expansion	Second expansion	Third expansion
E8RS/E8RM	Input: 4 points	X20 to X23	X40 to X43	X60 to X63
	Output: 4 points	Y20 to Y23	Y40 to Y43	Y60 to Y63
E8X	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
E8YT/E8YP	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16RS/E16RM/ E16T/E16P	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16X	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
E16YT/E16YP	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
E32T/E32P	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
A21	Input channel 0: 16 points	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Input channel 1: 16 points	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
	Output: 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
A80, TC4, TC8	Input CH0, 2, 4, 6: 16 points	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Input CH1, 3, 5, 7: 16 points	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
A04V, A04I	Input: 16 points	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Output CH0, 2, 4, 6: 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
	Output CH1, 3, 5, 7: 16 points	WY3 (Y30 to Y3F)	WY5 (Y50 to Y5F)	WY7 (Y70 to Y7F)
IOL	Input: 32 points	X20 to X3F	X40 to X5F	X60 to X7F
	Output: 32 points	Y20 to Y3F	Y40 to Y5F	Y60 to Y7F

- The channel data of FP0-A80, TC4, TC8, A04V and A04I will switch and be read or written by a user program that contains the conversion data switch flag.
- Please verify with the manual for the FP0 CC-Link Slave unit.

5.3 Expansion I/O Unit

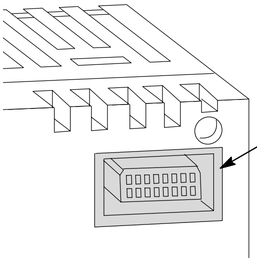
Chapter 6

Installation

6.1 Adding Expansion Units

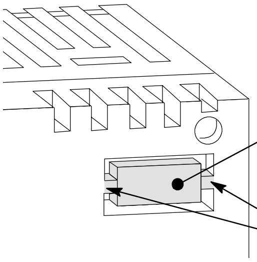
Expansion method

1. Peel the seal on the side of the unit so that the internal connector is exposed.



☞ Notes

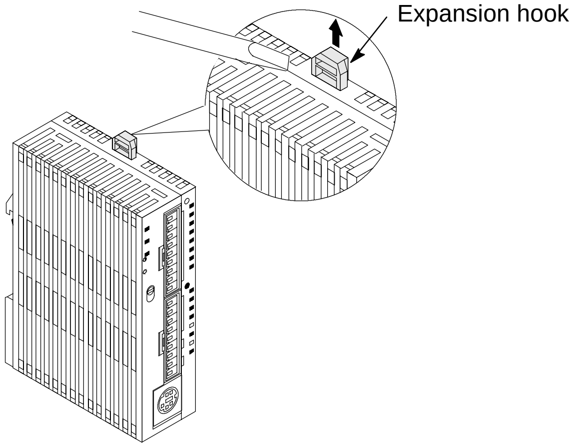
- **When peeling the seal on the side of the initial lot products, the shaded part is exposed. Cut off the shaded part with a pair of nippers or similar tool so that the internal connector is exposed.**



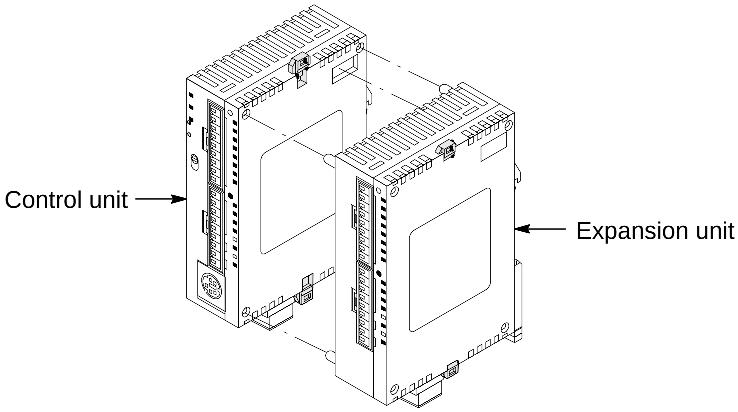
- **When removing the shaded part, use a sharp cutting object, making sure that the shaded part is removed leaving a smooth surface. Note that failure to remove the shaded part completely can result in damage to the connector.**

☛ next page

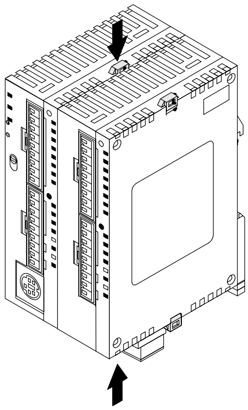
2. Raise the expansion hooks on the top and bottom sides of the unit with a screwdriver.



3. Align the pins and holes in the four corners of the control unit and expansion unit, and insert the pins into the holes so that there is no gap between the units.



4. Press down the expansion hooks raised in step 2 to secure the unit.



6.2 Important Notes

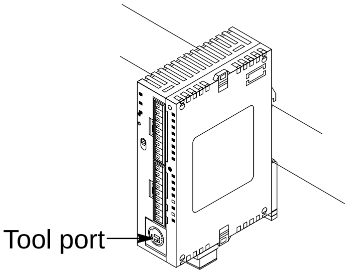
Please, read the following notes carefully before the installation of your FP0.

☞ **Notes**

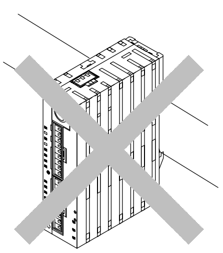
- **Avoid installing the unit in the following locations:**
  - **Ambient temperatures outside the range of 0°C to 55°C/32°F to 131°F**
  - **Ambient humidity outside the range of 30% to 85% RH**
  - **Sudden temperature changes causing condensation**
  - **Inflammable or corrosive gases**
  - **Excessive airborne dust or metal particles**
  - **Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda**
  - **Excessive vibration or shock**
  - **Direct sunlight**
  - **Water in any form including spray or mist**
- **Avoid noise interference from the following items:**
  - **Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges**
  - **If noise occurs in the power supply line even after the above countermeasures are taken, it is recommended to supply power through an insolated transformer, noise filter, or like.**

☛ next page

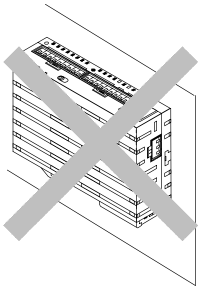
- **Measures regarding heat discharge**
  - **Always install the unit orientated with the tool port facing outward on the bottom in order to prevent the generation of heat.**



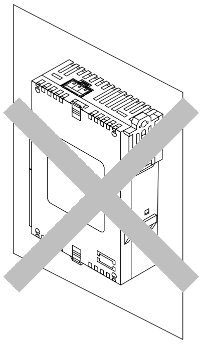
  - **Do not install the FP0 control unit as shown below.**



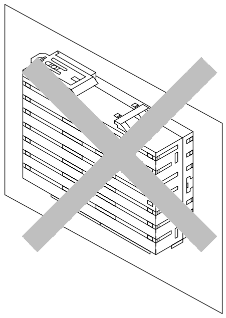
Upside-down



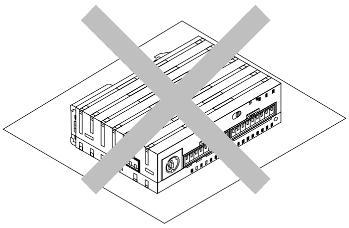
I/O connectors or I/O terminals on top



Installation which blocks the air duct



Installations such that the I/O connectors or I/O terminals face down

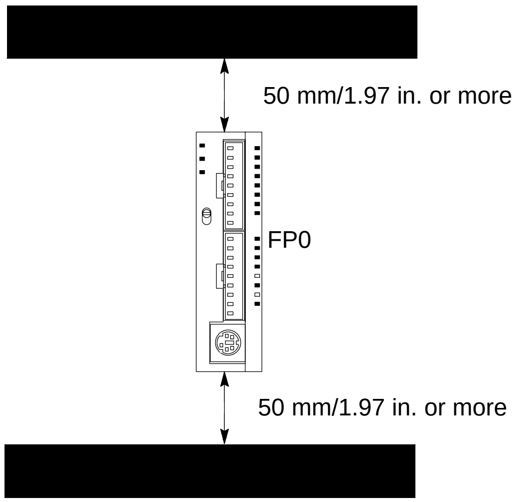


Horizontal installation of the unit

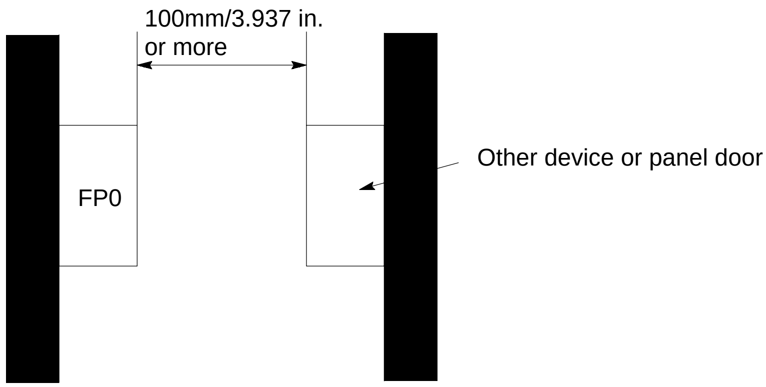
  - **Do not install the unit above devices which generate heat such as heaters, transformers or large scale resistors.**

☛ next page

- **Installation space**
  - **Leave at least 50 mm/1.97 in. of space between the wiring ducts of the unit and other devices to allow heat radiation and unit replacement.**



  - **Maintain a minimum of 100 mm/3.937 in. between devices to avoid adverse affects from noise and heat when installing a device or panel door to the front of the FP0 unit.**



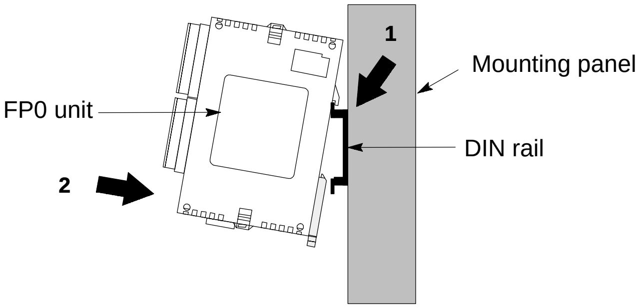
  - **Keep the first 100 mm/3.937 in. from the front surface of the FP0 control unit open in order to allow room for programming tool connections and wiring.**

6.3 Attachment to DIN Rails

The FP0 unit enables one-touch attachment to DIN rails.

Procedure:

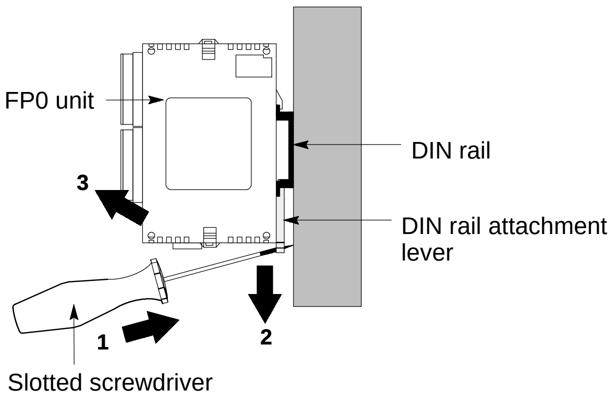
1. **Fit the upper hook of the FP0 unit onto the DIN rail.**
2. **Without moving the upper hook, press on the lower hook to fit the FP0 unit into position.**



You can easily remove the FP0 unit as described below.

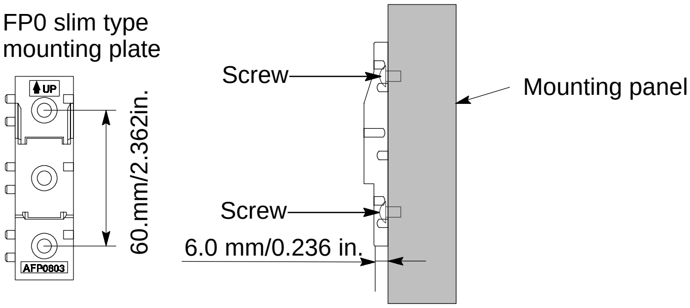
Procedure:

1. **Insert a slotted screwdriver into the DIN rail attachment lever.**
2. **Pull the attachment lever downwards.**
3. **Lift up the FP0 unit and remove it from the rail.**



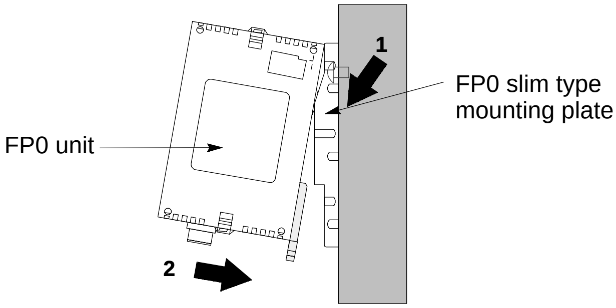
6.4 Installation Using FP0 Slim Type Mounting Plate

Use M4 size pan-head screws for attachment of FP0 slim type mounting plate (AFP0803) to mounting panel. For a diagram showing detailed dimensions of the FP0 slim type mounting plate, see *section A.4.



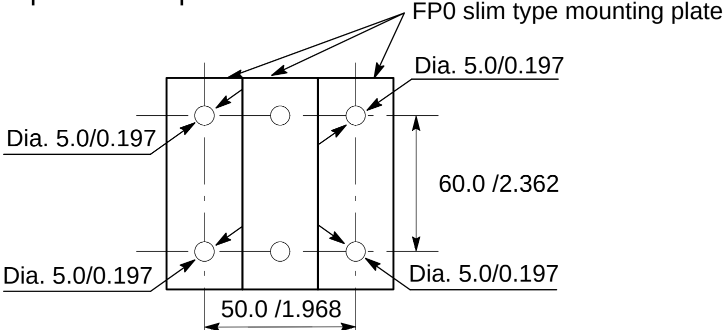
Procedure:

1. **Fit the upper hook of the FP0 unit onto the FP0 slim type mounting plate.**
2. **Without moving the upper hook, press on the lower hook to fit the FP0 unit into position.**



When using an expansion unit, tighten the screws after joining all of the FP0 slim type mounting plate to be connected. Tighten the screws at each of the four corners.

Example: Two expansion units

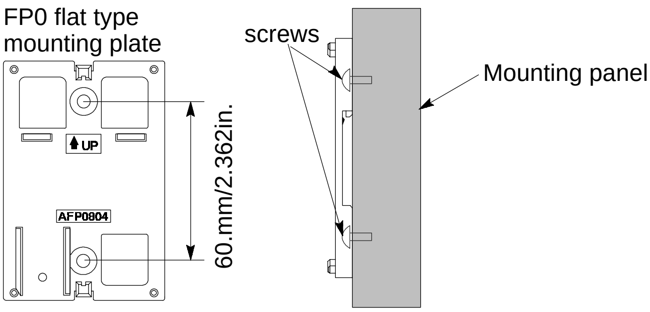


(unit: mm/in.)

6.5 Installation Using FP0 Flat Type Mounting Plate

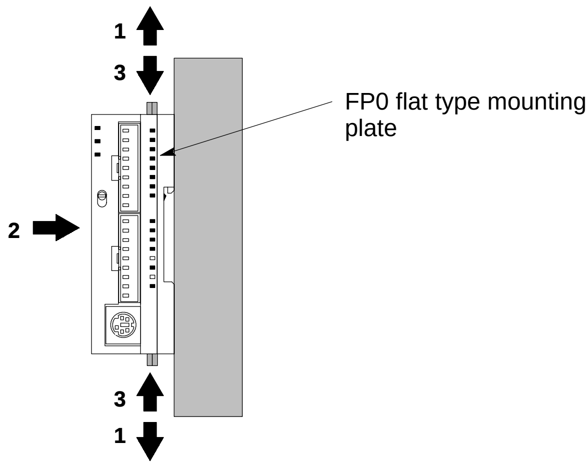
Use M4 size pan-head screws for attachment of FP0 flat type mounting plate (AFP0804) and install according to the dimensions shown below.

For a diagram showing detailed dimensions of the FP0 flat type mounting plate, see *section A.5.



Procedure:

1. **Raise the expansion hooks on the top and bottom of the unit.**
2. **Install the FP0 unit on the FP0 flat type mounting plate.**
3. **Align the expansion hooks with the plate and press the hooks back down.**

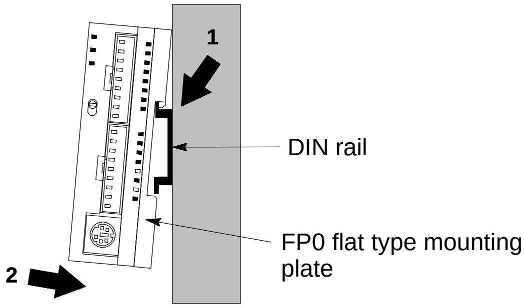


Notes

- **The FP0 flat type mounting plate (AFP0804) cannot be used for an expansion unit.**

next page

- **An FP0 unit with an attached FP0 flat type mounting plate can also be installed sideways on a DIN rail.**



6.5 Installation Using FP0 Flat Type Mounting Plate

Chapter 7

Wiring

7.1 Safety Instructions

In certain applications, malfunction may occur for the following reasons:

- Power ON timing differences between the FP0 control unit and I/O or motorized devices
- An operation time lag when a momentary power drop occurs
- Abnormality in the FP0 unit, power supply circuit, or other devices

In order to prevent a malfunction resulting in system shutdown choose the adequate safety circuits or other safety measures listed in the following:

7.1.1 Interlock Circuit

When a motor clockwise/counter-clockwise operation is controlled, provide an interlock circuit that prevents clockwise and counter-clockwise signals from inputting into the motor at the same time.

7.1.2 Emergency Stop Circuit

Add an emergency stop circuit to controlled devices in order to prevent a system shutdown or an irreparable accident when malfunction occurs.

7.1.3 Start Up Sequence

The FP0 should be operated after all of the outside devices are energized. To keep this sequence, the following measures are recommended:

- Set the mode switch from PROG. mode to RUN mode after power is supplied to all of the outside devices
- Program the FP0 so as to disregard the inputs and outputs until the outside devices are energized

☞ **Note**

When stopping the operation of FP0 also, have the I/O devices turned OFF after the FP0 has stopped operating.

☛ next page

7.1.4 Momentary Power Failures

If the duration of the power failure is less than 5 ms, the FP0 continues to operate. If the power is OFF for 5 ms or longer, operation changes depending on the combination of units, the power supply voltage, and other factors. (In some cases, operation may be the same as that for a power supply reset.)

If operation is to be continued following recovery from the momentary power failure, use an automatic retaining sequence program that uses a hold type internal relay.

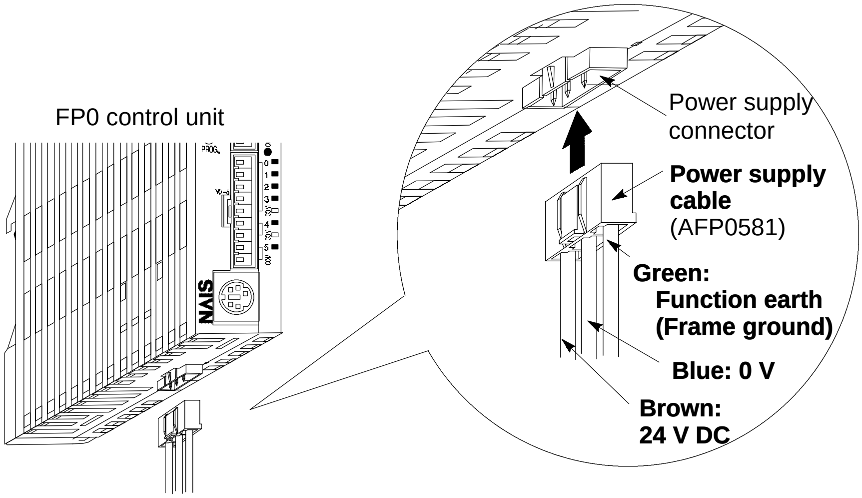
7.1.5 Protecting Power Supply and Output Sections

An insulated power supply with an internal protective circuit should be used. The power supply for the control unit operation is a non-insulated circuit, so if an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed. If using a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.

If current exceeding the rated control capacity is being supplied in the form of a motor lock current or a coil shorting in an electromagnetic device, a protective element such as a fuse should be attached externally.

7.2 Wiring the Power Supply to the Control Unit

Use the power supply cable (AFP0581) that comes with the unit to connect the power supply.



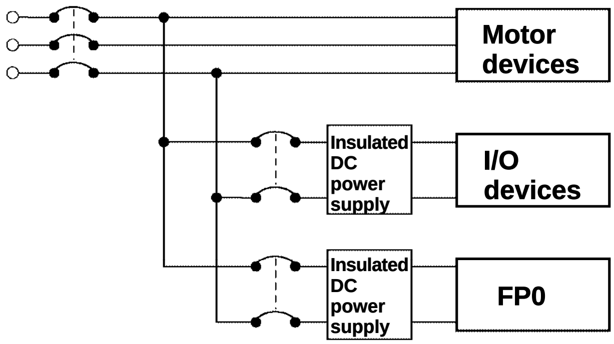
Item	Descriptions
Rated voltage	24 V DC
Operating voltage range	21.6 to 26.4 V DC

Notes

- **To minimize adverse effects from noise, twist the brown and blue wires of the power supply cable.**
- **To protect the system against erroneous voltage from the power supply line, use an insulated power supply with an internal protective circuit.**
- **The regulator on the FP0 unit is a non-insulated type.**
- **If using a power supply device without an internal protective circuit, always make sure power is supplied to the unit through a protective element such as a fuse.**

☛ next page

- **Isolate the wiring systems to the FP0, input/output devices, and motor devices.**

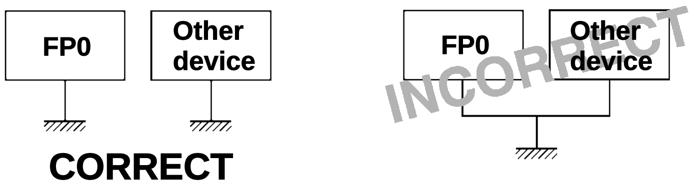


- **The power supply sequence should be set up so that power to the control unit is turned OFF before the input/output power supplies.**
- **If the input/output power supplies are turned OFF before the power to the control unit, the FP0 control unit may detect a drop in the input level, and malfunction.**
- **Be sure to supply power to a control unit and an expansion unit from the same power supply, and turn the power ON and OFF simultaneously for both.**

7.3 Grounding

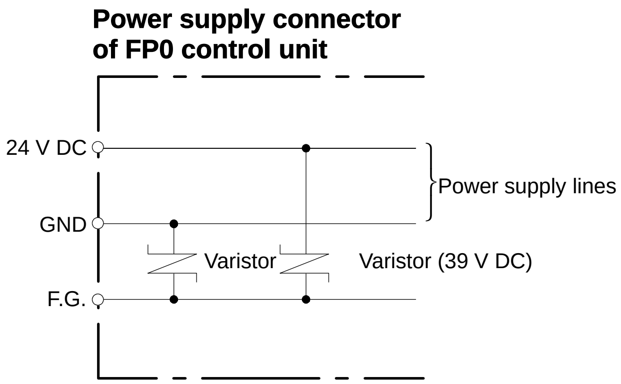
Under normal conditions, the inherent noise resistance is sufficient. However, in situations of excess noise, ground the instrument to increase noise suppression.

For grounding purposes, use wiring with a **minimum of 2 mm^2**. The grounding connection should have a resistance of **less than 100 Ω**.



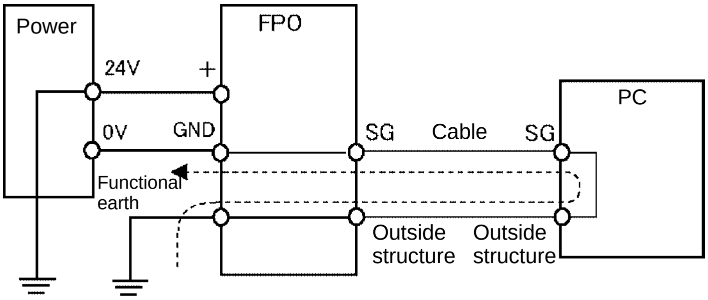
Notes

- **The point of grounding should be as close to the FP0 control unit as possible. The ground wire should be as short as possible.**
- **If two devices share a single ground point, it may produce an adverse effect. Always use an exclusive ground for each device.**
- **Depending on the surroundings in which the equipment is used, grounding may cause problems.**
  <Example>
  Since the power supply line (24 VDC and GND terminal) of the FP0 power supply connector is connected to the frame ground (F.G.) through a varistor, if there is an irregular potential between the power supply line (24 VDC and GND) and earth, the varistor may be shorted.



When the plus side is grounded, do not ground the functional earth terminal.

Do not ground the FP0 functional earth terminal if the plus terminal of the power supply is grounded.
Depending on the PC, some types have the SG terminal of the RS232C port connected to the outside structure of the connector. Also, the outside structure of the FP0 tool port is connected to the functional earth terminal. For this reason, connecting a PC will connect the FP0 GND terminal to the functional earth terminal. In particular, because a voltage of -24 V will be applied to the GND terminal when the plus terminal is grounded, a potentially damaging short circuit will occur when, in this state, the GND terminal and functional earth are connected.



7.4 Input Wiring

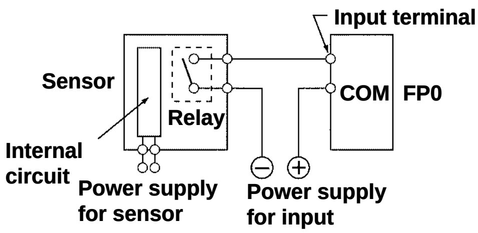
Notes

- **Be sure to select the thickness (dia.) of the input wires while taking into consideration the required current capacity.**
- **Arrange the wiring so that the input and output wiring are separated, and so that the input wiring is separated from the power wiring, as much as possible. Do not route them through the same duct or wrap them up together.**
- **Separate the input wires from the power and high voltage wires by at least 100 mm/3.937 in.**

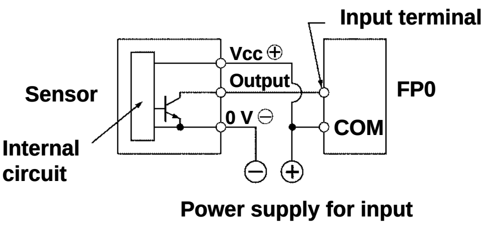
In this section you find some examples for wiring sensors, an LED-equipped reed switch, a two-wire type sensor and a LED-equipped limit switch.

7.4.1 Sensors

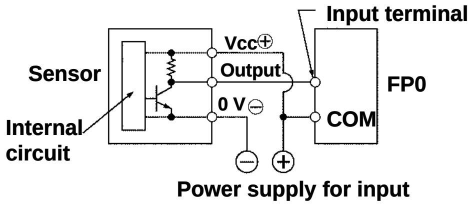
Relay output type



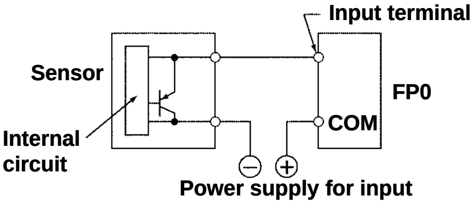
NPN open collector output type



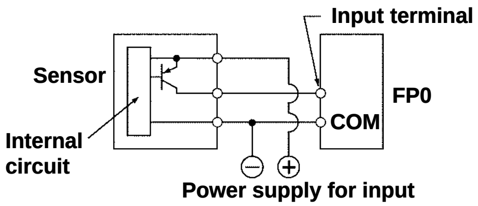
Universal output type



Two-wire type (* next page)

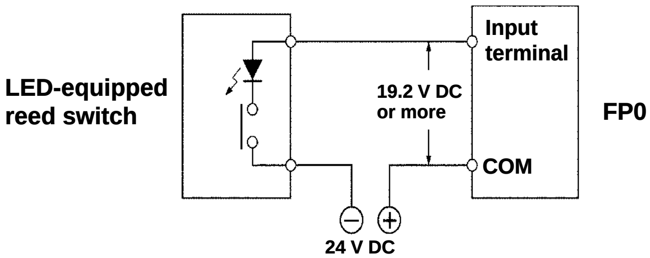


PNP open collector output type



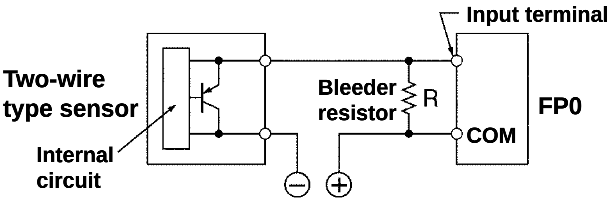
7.4.2 LED-Equipped Reed Switch

When a LED is connected to an input contact such as LED-equipped reed switch, make sure that the ON voltage applied to the FP0 input circuit is greater than 19.2 V DC. In particular, take care when connecting a number of switches in series.



7.4.3 Two-Wire Type Sensor

If the input of the FP0 does not turn OFF because of leakage current from the two-wire type sensor, the use of a bleeder resistor is recommended, as shown below.



I: Sensor's leakage current (mA)

R: Bleeder resistor (kΩ)

The OFF voltage of the FP0 input is 2.4 V, therefore, select an R value so that the voltage between the COM terminal and the input terminal will be less than 2.4 V.
(The impedance of the FP0 input terminal is 5.6 kΩ.)

The resistance R of the bleeder resistor is: $R \leq \dfrac{13.44}{5.6 \times I - 2.4}$ (kΩ)

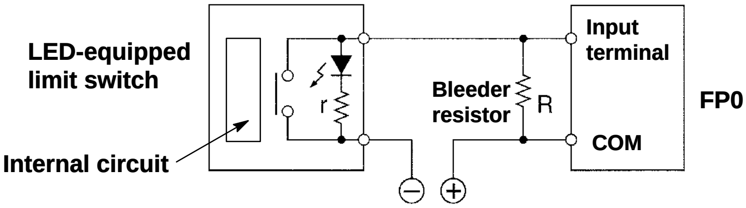
The wattage W of the resistor is:

$$W = \frac{(\text{Power supply voltage})^2}{R}$$

In the actual selection, use a value that is 3 to 5 times the value of W.

7.4.4 LED-Equipped Limit Switch

If the input of the FP0 does not turn OFF because of the leakage current from the LED-equipped limit switch, the use of a bleeder resistor is recommended, as shown below.



r: Internal resistor of limit switch (kΩ)

R: Bleeder resistor (kΩ)

The OFF voltage of the FP0 input is 2.4 V, therefore when the power supply voltage is 24 V, select R so that

the current will be greater than $I = \dfrac{24 - 2.4}{r}$

The resistance R of the bleeder resistor is: $R < \text{or} = \dfrac{13.44}{5.6 \times I - 2.4}$ (kΩ)

The wattage W of the resistor is: $W = \dfrac{(\text{Power supply voltage})^2}{R}$

In the actual selection, use a value that is 3 to 5 times the value of W.

7.5 Output Wiring

Notes

- **There is no fuse protection built into the output circuit. Therefore, in order to protect against overheating of the output circuitry caused by possible short circuits, install an external fuse at each point. However, in cases such as short circuits, the control unit itself may not be protected.**
- **Be sure to select the thickness (dia.) of the output wires while taking into consideration the required current capacity.**
- **Arrange the wiring so that the input and output wiring are separated, and so that the output wiring is separated from the power wiring, as much as possible. Do not route them through the same duct or wrap them up together.**
- **Separate the output wires from the power and high voltage wires by at least 100 mm/3.937 in.**

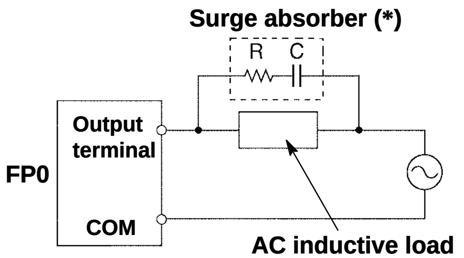
Protect the outputs as described below:

7.5.1 Protective Circuit for Inductive Loads

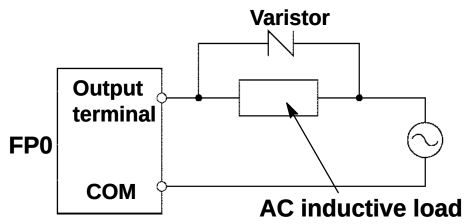
With an inductive load, a protective circuit should be installed in parallel with the load.

When switching DC inductive loads with FP0 relay output type, be sure to connect a diode across the ends of the load.

When using an AC inductive load

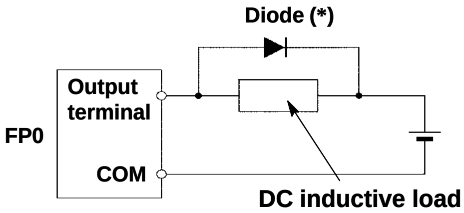


(*) Example of surge absorber:
[R: 50 Ω, C: 0.47 μF]



☛ next page

When using a DC inductive load

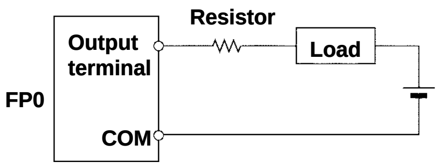


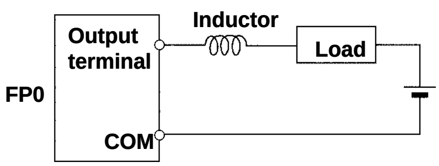
(*) Diode:

Reverse voltage (V_R): 3 times the load voltage
Average rectified forward current (I_0): Load current or more

7.5.2 Precautions for Using Capacitive Loads

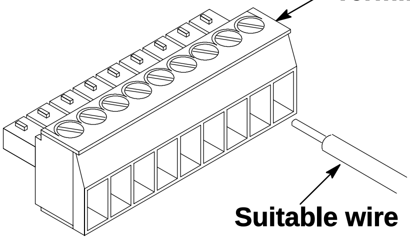
When connecting loads with large in-rush currents, to minimize their effect, connect a protection circuit as shown below.





7.6 Wiring the Terminal Type

A screw-down connection type terminal block socket for terminal of FP0 control unit and analog I/O unit is used. The terminal block socket and suitable wires are given below.



Terminal block socket

Item	Description
Manufacturer	Phoenix Contact Co.
Model	MC1,5/9-ST-3,5
Product number	1840434

Suitable wires (twisted wire)

Item	Description
Control unit	Size: AWG #24 to 16
	Conductor cross-sectional area: 0.3 to 1.25 mm^2
Analog I/O unit	Size: AWG #28 to 16
	Conductor cross-sectional area: 0.08 to 1.25 mm^2

Pole terminal with a compatible insulation sleeve

If a pole terminal is being used, the following models are marketed by Phoenix Contact Co.

Manufacturer	Cross-sectional area (mm^2)	Size	Product number
Phoenix Contact Co.	0.25	AWG #24	AI 0,25-6YE
	0.50	AWG #20	AI 0,5-6WH
	0.75	AWG #18	AI 0,75-6GY
	1.00	AWG #18	AI 1-6RD

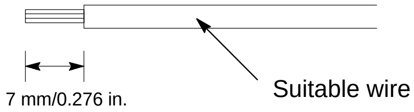
Pressure welding tool for pole terminals

Manufacturer	Phoenix Contact Co.
Type	CRIMPFOX UD6
Product number	12 04 43 6

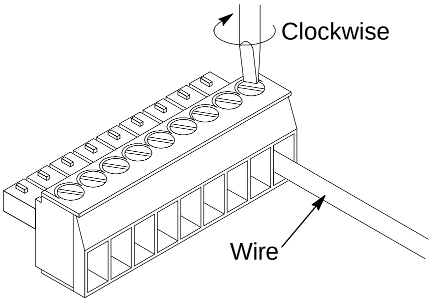
When tightening the terminals of the terminal block socket, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 $\times$ 2.5. The tightening torque should be 0.22 to 0.25 N·m (2.3 to 2.5 kgf·cm) or less.

Procedure:

1. **Remove a portion of the wire's insulation.**

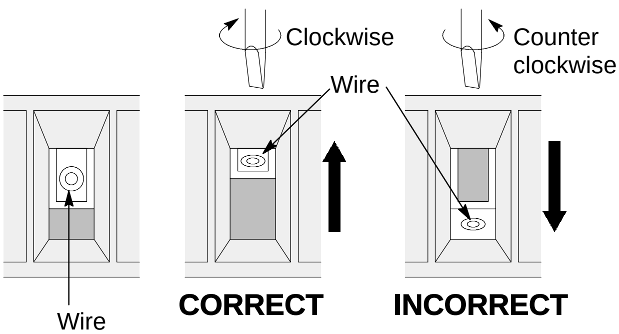


2. **Insert the wire into the terminal block socket until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place.**



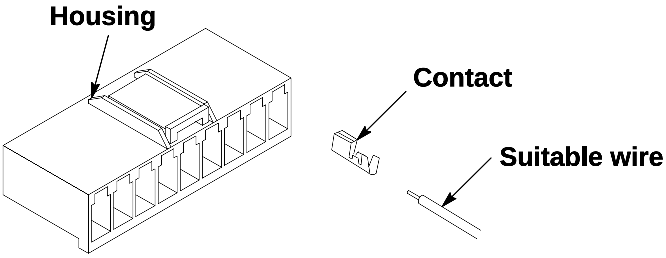
Notes

- **When removing the wire's insulation, be careful not to scratch the core wire.**
- **Do not twist the wires to connect them.**
- **Do not solder the wires to connect them. The solder may break due to vibration.**
- **After wiring, make sure stress is not applied to the wire.**
- **In the terminal block socket construction, if the wire closes upon counter-clockwise rotation, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.**



7.7 Wiring the MOLEX Connector Type

The housings and contacts listed below come supplied with the FP0. Use the wires given below. Also, use the required special tool for connecting the wires.



Supplied connector

Manufacturer	Item	Product number
Molex Japan Co., Ltd.	Housing	51067-0900 (2 pieces)
	Contact	50217-8100 (20 pieces)

Suitable wires (twisted wire)

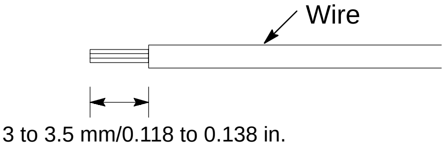
- Size: AWG #24 to 18
- Conductor cross-sectional area: 0.2 to 0.75 mm^2
- Insulation outside diameter: dia. 1.4 to dia. 3.0

Special crimping tool

- Manufacturer: Molex Japan Co., Ltd
- Product number: 57189-5000

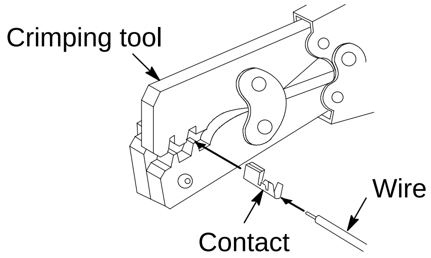
Procedure:

1. Remove a portion of the wire’s insulation.

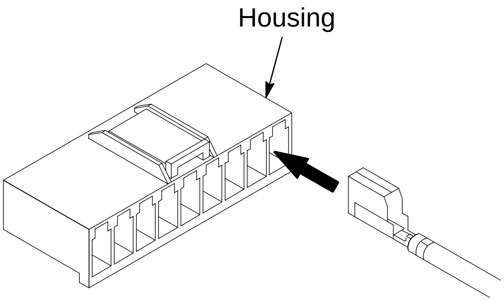


☛ next page

2. **Place the contact in the crimping tool, place the wire in the contact and lightly squeeze the tool.**

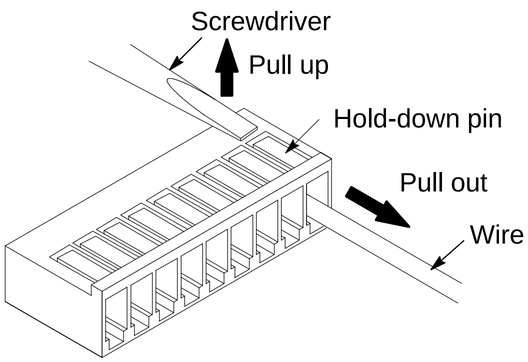


3. **Insert the crimped wire into the housing until it contacts the back side.**



☞ Note

When removing a wire, use a flat-head screwdriver, or other similar tool, to pull up the hold-down pin of the housing and then pull out the wire.



7.8 Wiring the MIL Connector Type

The housings, semi-cover and pressure welders listed below come supplied with the FP0. Use the wires given below. Also, use the required pressure connection tools for connecting the wires.

Supplied connector

Unit	Type/Order number		C16/E16	C32/E32
C16/C32 E16/E32	Housing	10-pin type only	2 pieces	4 pieces
	Semi-cover	AXW61001	2 pieces	4 pieces
	Welder (contact)	AXW7221	5-pin × 4	5-pin × 8

Suitable wires (twisted wire)

Size	Conductor cross-sectional area	Insulation thickness	Rated current
AWG#22	0.3 mm^2	dia. 1.5 to dia. 1.1	3A
AWG#24	0.2 mm^2		

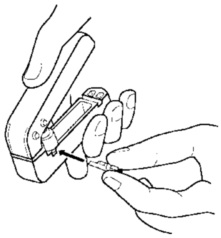
Pressure connection tool

- Order number: AXY52000

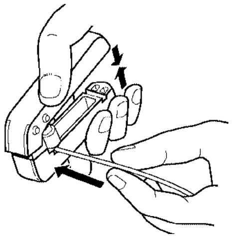
Procedure:

The wire end can be directly crimped without removing the wire's insulation, saving labor.

1. **Bend the welder (contact) back from the carrier, and set it in the pressure connection tool.**

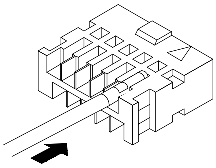


2. **Insert the wire without removing its insulation until it stops, and lightly grip the tool.**

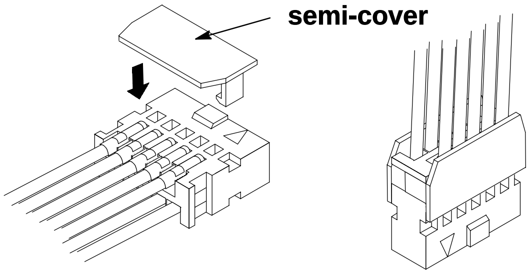


☛ next page

3. After press-fitting the wire, insert it into the housing.



4. When all wires has been inserted, fit the semi-cover into place.

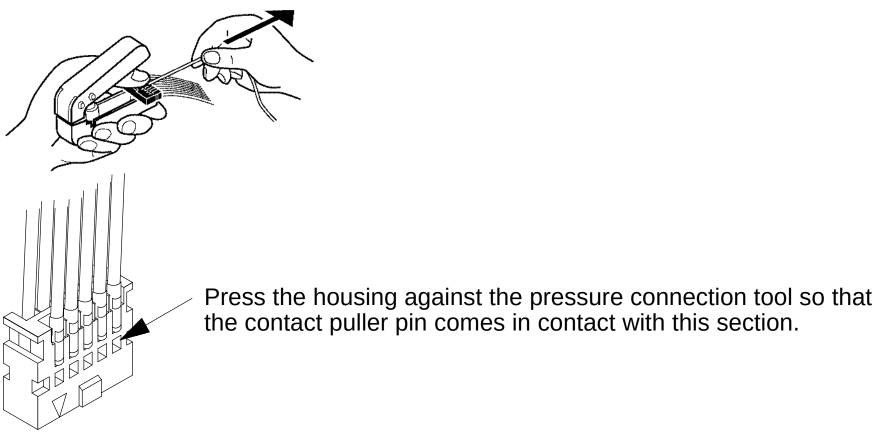


Note

If using a MIL connector for flat cables, please specify the order number AXM110915.

7.8.1 Contact Puller Pin for Rewiring

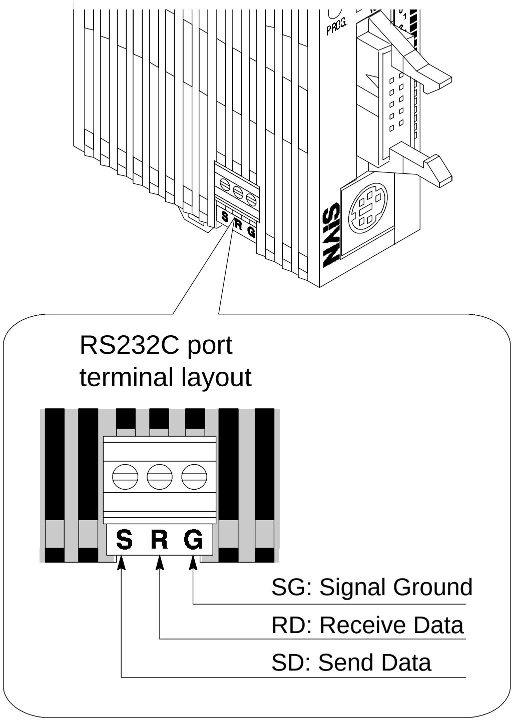
If there is a wiring mistake or the cable is incorrectly pressure-connected, the contact puller pin provided with the fitting can be used to remove the contact.



7.9 Wiring the RS232C Port

When using the RS232C port, use the screw-down connection type terminal and the wire according to the following procedures.

FP0 Control unit with RS232C port
(FP0 C10CRM/C10CRS/C14CRM/C14CRS/C16CT/C16CP/C32CT/C32CP)



Item	Specification
Baud rate	300/600/1200/2400/4800/ 9600/19200 bps
Transmission distance	3m/9.84 ft.
Terminal block	Made by Phoenix Contact Co. (3-pin) Product number: MKDS 1/3-3.5
Communication method	half-duplex

Settings when shipped from the factory

These are changed using system registers 412 to 414. The settings in effect when the unit is shipped from the factory are noted below.

412	RS232C port is not used.
413	Character bit: 8 bits Parity check: odd Stop bit: 1 bit Header: without STX code Terminator: CR
414	Baud rate: 9600 bps

Suitable wires (twisted wire)

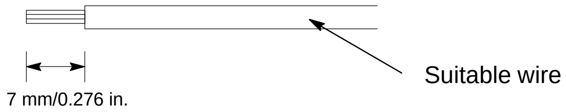
- Size: AWG #28 to 16
- Conductor cross-sectional area: 0.08 to 1.25 mm^2

Use a shielded wire of the above wiring. We recommend grounding the shield section. Also, if using a pole terminal, see * section 7.6.

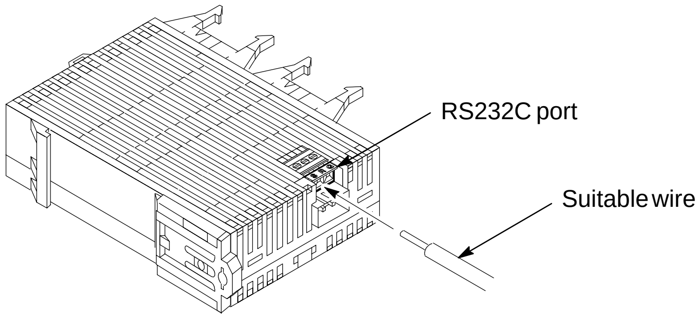
When tightening the RS232C port, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 $\times$ 2.5. The tightening torque should be 0.22 to 0.25 N·m (2.3 to 2.5 kgf·cm) or less.

Procedure:

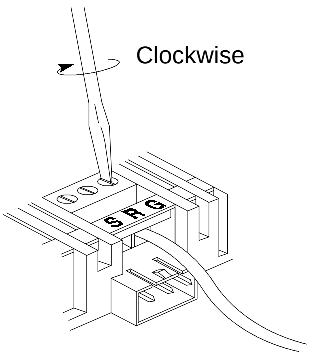
1. **Remove a portion of the wire's insulation.**



2. **Insert wire into the RS232C port until it contacts the back of the RS232C port.**

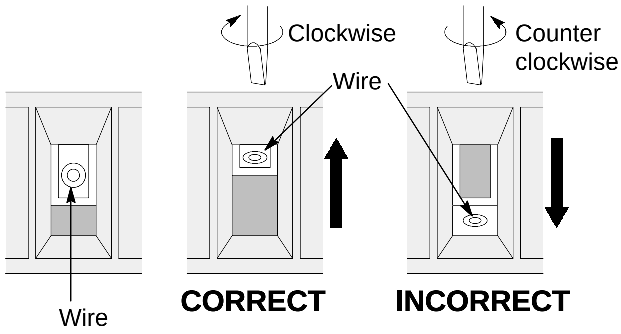


3. **Tighten the screw clockwise to fix the wire in place.**



Notes

- **When removing the wire's insulation, be careful not to scratch the core wire.**
- **Do not twist the wires to connect them.**
- **Do not solder the wires to connect them. The solder may break due to vibration.**
- **After wiring, make sure stress is not applied to the wire.**
- **In the RS232C port terminal construction, if the wire closes upon counter-clockwise rotation, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.**



Chapter 8

Precautions During Programming

☛ next page

8.1 Use of Duplicated Output

8.1.1 Duplicated Output

Duplicated output refers to repeatedly specifying the same output in a program.

If the same output is specified for the “**OT**” and “**KP**” instructions, it is considered to be duplicated output.
Even if the same output is used for multiple instructions, such as the **SET** or **RST** instruction, or high-level instruction for data transfer, it is not regarded as duplicated output.

If you enter RUN mode while the duplicated output condition exists, under normal conditions, it will be flagged as an error, the ERROR/ALARM LED will light and the self-diagnostic error flag R9000 will go on.

How to Check for Duplicated Use

You can check for duplicated outputs in the program using the programming tool, by the following method:

Using FP Programmer II:
Operate the TOTAL CHECK function.
Key operation: [(-) OP] [9] [ENT] [READ ▼]
If there are any duplicated outputs, an error message (DUP USE) and the address will be displayed.

Using FPWIN GR software:
Execute the “Debug” on “Totally Check Program.”
If there are any duplicated outputs, an error message (DUPLICATED OUTPUT ERROR) and the address will be displayed. If you execute “SEARCH AN ERROR,” the error message will be displayed, and the first address number will be displayed.

Enabling Duplicated Output

If you need to use output repeatedly due to the content of the program, duplicated output can be enabled.

In this case, change the setting of system register 20 to ”enable” (when using FP Programmer II, set K1).

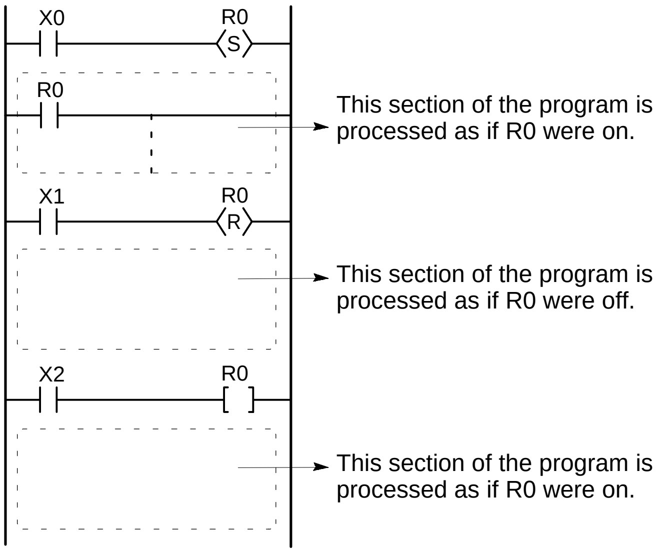
When this is done, an error will not occur when the program is executed.

8.1.2 When Output is Repeated with an OT, KP, SET, or RST Instruction

Condition of Internal and Output Relays During Operation

When instructions are repeatedly used which output to internal and output relays such as transfer instructions and **OT**, **KP**, **SET** and **RST** instructions, the contents are rewritten at each step during operation.

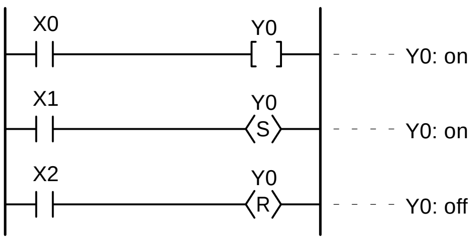
Example: Processing when SET, RST and OT instructions are used (X0 to X2 are all on).



The output is determined by the final operation results

If the same output is used by several instructions such as the **OT**, **KP**, **SET**, **RST**, or data transfer instructions, the output obtained at the I/O update is determined by the results of the operation at the greatest program address.

Example: Output to the same output relay Y0 with OT, SET and RST instructions.



When X0 to X2 are all on, Y0 is output as off at I/O update.

If you need to output a result while processing is still in progress, use a partial I/O update instruction **“F143 (IORF)”**.

8.2 Handling BCD Data

8.2.1 BCD Data

BCD is an acronym for binary-coded decimal, and means that each digit of a decimal number is expressed as a binary number.

Example:

Expressing a decimal number in BCD:

Decimal number	6	4	5
BCD (Binary-coded decimal)	0110	0100	0101

Each digit is converted to a binary number.

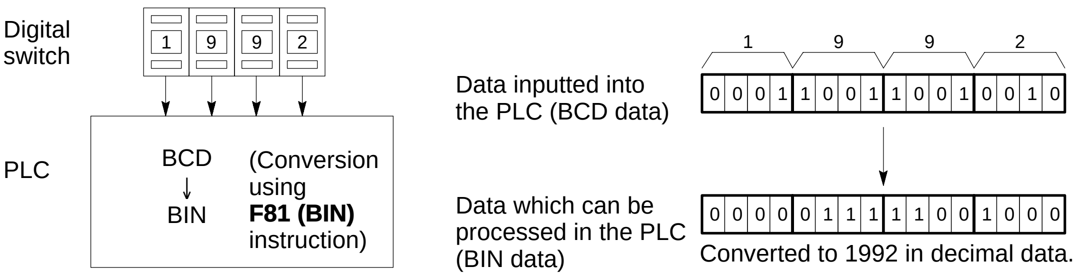
8.2.2 Handling BCD Data in the PLC

When inputting data from a digital switch to the PLC or outputting data to a 7-segment display (with a decoder), the data must be in BCD form. In this case, use a data conversion instruction as shown in the examples at below.

BCD arithmetic instructions “**F40 (B+)** to **F58 (DB-1)**” also exist which allow direct operation on BCD data, however, it is normally most convenient to use BIN operation instructions “**F20 (+)** to **F38(D-1)**” as operation in the PLC takes place in binary.

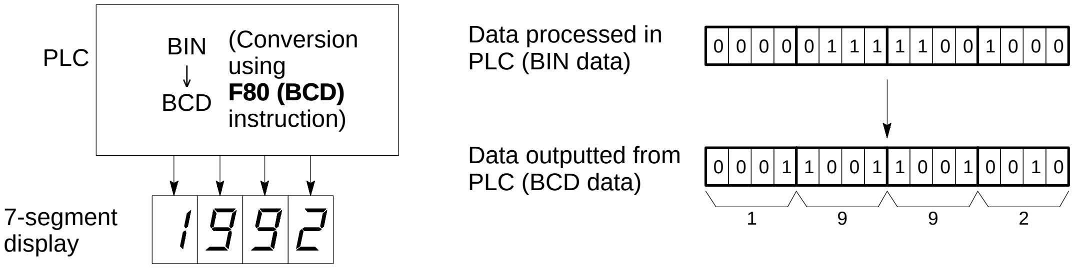
Input From a Digital Switch

Use the BCD-to-BIN conversion instruction **“F81 (BIN)”**.



Output to a 7-segment Display (with Decoder)

Use the BIN-to-BCD conversion instruction **“F80 (BCD)”**.



8.3 Handling Index Registers

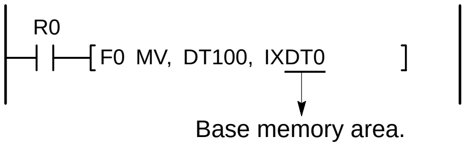
8.3.1 Index Registers

Like other registers, index registers have two points, IX and IY, for reading and writing 16-bit data.

Use an index register to indirectly specify a memory area number. (This is also called index modification.)

Example:

Transferring the contents of data register DT100 to the number specified by the contents of an index register.



In this example, the number of the destination data register varies depending on the contents of IX with DT0 acting as a base. For example, when IX contains K10 the destination will be DT10, and when IX is K20, the destination will be DT20.

In this way, index registers allow the specification of multiple memory areas with a single instruction, and thus index registers are very convenient when handling large amounts of data.

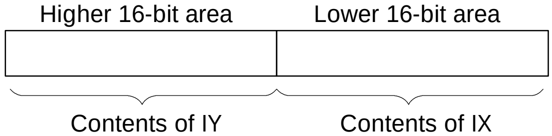
8.3.2 Memory Areas Which can be Modified with Index Registers

Index registers can be used to modify other types of memory areas in addition to data registers DT.
IXWX0, IXWY1, IXWR0, IXSV0, IXEV2, IXDT100

Constants can also be modified.
IXK10, IXH1001

An index register cannot modify another index register.
IXIX, IXIY

When using index modification with an instruction which handles 32-bit data, specify with IX. In this case, IX and IY are handled together as 32-bit data.

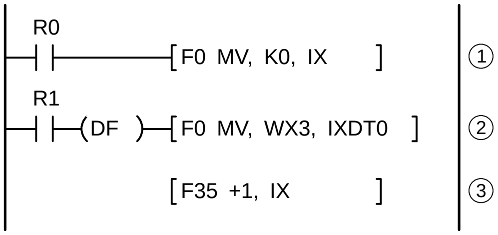


8.3.3 Example of Using an Index Register

Repeatedly Reading in External Data

Example:

Writing the contents of word external input relay WX3 to a sequence of data registers beginning from DT0.



① **When R0 turns on, K0 is written to index register IX.**

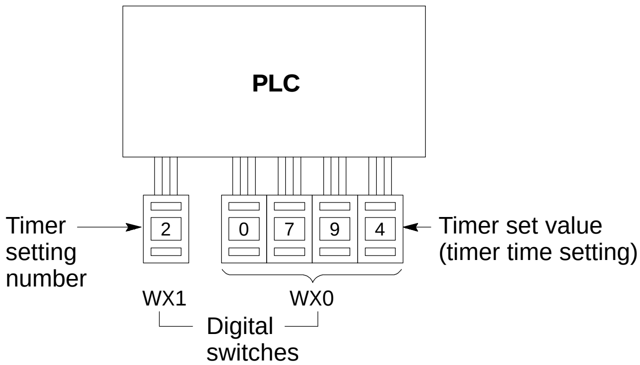
② **When the R1 turns on, the contents of WX3 is transferred to the data register specified by IXDT0.**

③ **Add 1 to IX.**
In this case, the contents of IX will change successively, and the destination data register will be as follows.

Input times of R1	Contents of IX	Destination data register
1st	0	DT0
2nd	1	DT1
3rd	2	DT2
:	:	:

Inputting and Outputting Data Based on a Number Specified by an Input

Example 1: Setting a timer number specified by a digital switch



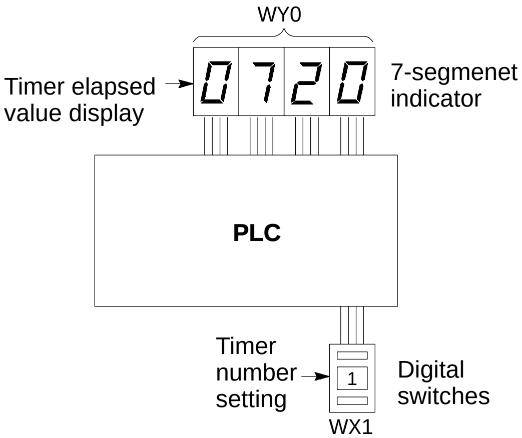
```
  R0
|—| |—(DF )—[F81 BIN, WX1, IX     ]  | ①

            [F81 BIN, WX0, IXSV0  ]  | ②
```

① **Convert the BCD timer number data in WX1 to binary and set it in index register IX.**

② **Convert the BCD timer set value in WX0 to binary and stored in the timer set value area SV specified by contents of IX.**

Example 2: External output of the elapsed value in a timer number specified by a digital switch




```
  R1
|—| |—(DF )—[F81 BIN, WX1, IX     ]  | ①

            [F80 BCD, IXEV0, WY0  ]  | ②
```

① **Convert the BCD timer number data in WX1 to binary, and set it in index register IX.**

② **Convert the elapsed value data EV in the timer specified by IX to BCD, and output it to word external output relay WY0.**

8.4 Operation Errors

8.4.1 Outline of Operation Errors

An operation error is a condition in which operation is impossible when a high-level instruction is executed.

When an operation error occurs, the ERROR/ALARM LED on the FP0 control unit will blink and the operation error flags (R9007 and R9008) will turn on.

The operation error code “E45” is set at special data register DT9000.

The error address is stored in special data registers DT9017 and DT9018.

Types of Operation Error

Address error

The memory address (number) specified by index modification is outside the area which can be used

BCD data error

Operation is attempted on non-BCD data when an instruction handling BCD is executed, or BCD conversion is attempted on data which is not within the possible conversion range.

Parameter error

In an instruction requiring the specification of control data, the specified data is outside the possible range.

Over area error

The data manipulated by a block instruction exceeds the memory range.

8.4.2 Operation Mode When an Operation Error Occurs

Normally, the operation stops when an operation error occurs.

However, when you set system register 26 to “continuation” (KI), the FP0 control unit operates even if an operation error occurs.

For detailed information ☛ section 12.4

8.4.3 Dealing with Operation Errors

Procedure:

1. **Check the location of the error.**

   Check the address where the error occurred, which is stored in DT9017 and DT9018, and make sure the high-level instruction for that address is correct and appropriate.

2. **Clear the error.**

   Use a programming tool to clear the error. (If the mode selector is set to RUN, RUN will resume as soon as the error is cleared.)

   In FP Programmer II, press the following keys.

   [ACLR] [(-) OP] [1] [1] [2] [ENT] [SHIFT SC] [(DELT) INST]

   An error can be cleared by turning the power off and on in PROG. mode, however, the contents of the operation memory except the hold type data will be cleared.

   An error can also be cleared by executing a **F148** (self-diagnostic error set) instruction.

8.4.4 Points to Check in Program

Check if an extraordinarily large value or negative value was stored in the index register.

Example: When a data register is modified using an index register

```
 R0
─┤ ├──[F0 MV, DT0, IXDT0          ]
```

In this case, index register (IX) modifies the address of data register DT0. If data in IX is larger than the last address of the data register, an operation error will occur. If the PLC you are using is of the FP0 16-point type, the last address of the data register is DT1659. If the data in IX exceeds the range of K0 to K255, an operation error will occur. The same is true when the contents of IX are negative.

Is there any data which cannot be converted using BCD ↔ BIN data conversion?

Example: When BCD-to-BIN conversion is attempted

```
 R0
─┤ ├──[F81 BIN, DT0, DT100        ]
```

In this case, if DT0 contains a hexadecimal number with one of the digits A through F such as 12A4, conversion will be impossible and an operation error will result.

Example: When BIN-to-BCD conversion is attempted

```
 R0
─┤ ├──[F80 BCD, DT1, DT101        ]
```

In this case, if DT1 contains a negative value or a value greater than K9999, an operation error will occur.

Check if the divisor of a division instruction is K0.

Example:

```
 R0
─┤ ├──[F32 %, DT0, DT100, DT200 ]
```

In this case, if the content of DT100 is K0, an operation error will occur.

8.5 Instruction of Leading Edge Detection Method

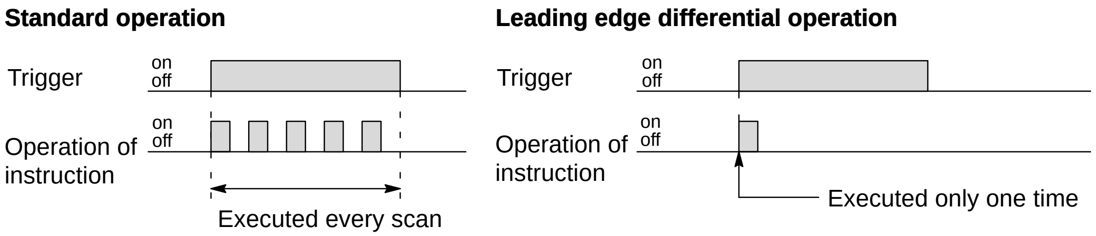
8.5.1 Instructions of Leading Edge Detection Method

Instructions Using the Leading Edge Detection Operation

DF (leading edge differential) instructions
Count input for **CT** instructions
Count input for **F118 (UDC)** instructions
Shift input for **SR** instructions
Shift input for **F119 (LRSR)** instructions
NSTP instructions

Leading Edge Detection Method

An instruction with a leading edge detection method operates only in the scan where its trigger (execution condition) is detected switching from off to on.



The condition of the previous execution and the condition of the current execution are compared, and the instruction is executed only if the previous condition was off and the current condition is on. In any other case, the instruction is not executed.

Precautions When Using an Instruction Which Performs Leading Edge Detection

When RUN begins, for example when the system is powered on, the off → on change of the execution condition (trigger) is not detected. The instruction is not executed. Execution of the instruction will take place as explained on section 8.5.2.

When used with one of the instructions indicated in instructions below which change the order of execution of instructions, the operation of the instruction may change depending on input timing. Take care regarding this point.

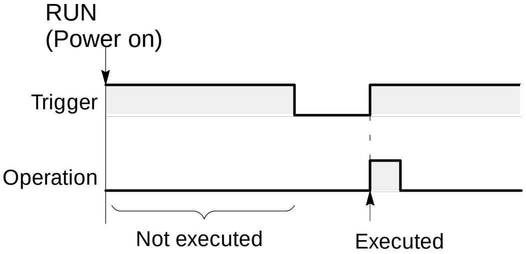
Be careful when using leading edge detection type instructions with control instructions, such as:

MC and **MCE** instructions
JP and **LBL** instructions
LOOP and **LBL** instructions
CNDE instruction
Step ladder instructions
Subroutine instructions

8.5.2 Operation and Precautions at Run Start Time

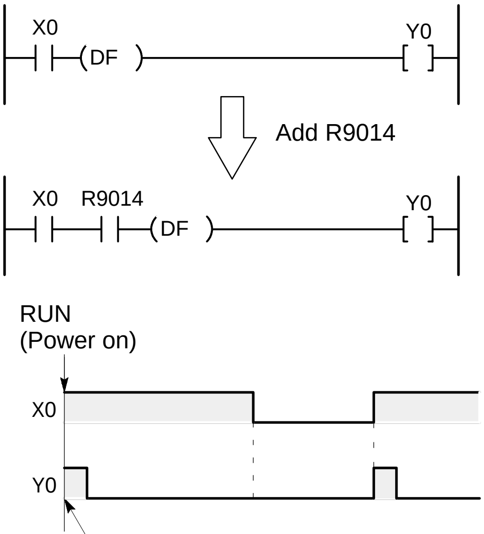
Operation of first scan after RUN begins

The leading edge detection instruction is not executed when the mode has been switched to the RUN mode, or when the power supply is booted in the RUN mode, if the trigger (execution condition) is already on.



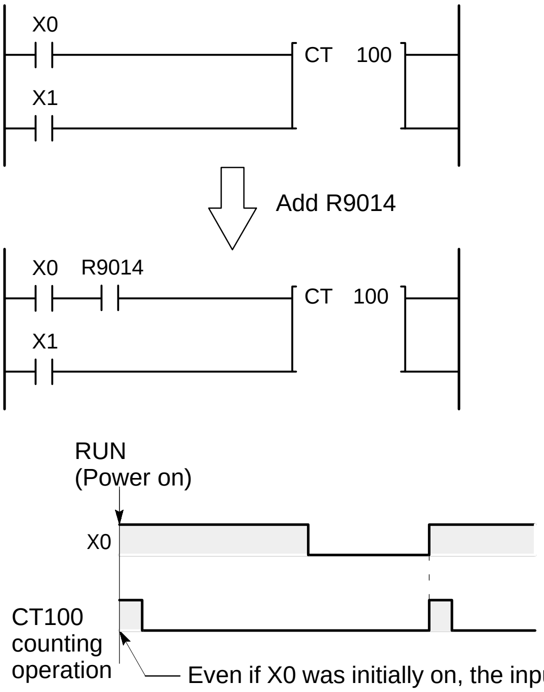
If you need to execute an instruction when the trigger (execution condition) is on prior to switching to RUN mode, use R9014 (initial pulse off relay) in your program on the following page. (R9014 is a special internal relay which is off during the first scan and turns on at the second scan.)

Example 1: DF (leading edge differential) instruction



Even if X0 was initially on, the input condition (X0) for the **DF** instruction is off-to-on at the second scan, therefore derivative output is obtained.

Example 2: CT (counter) instruction



Even if X0 was initially on, the input condition (X0) for the counter is off-to-on at the second scan, therefore the count is incremented.

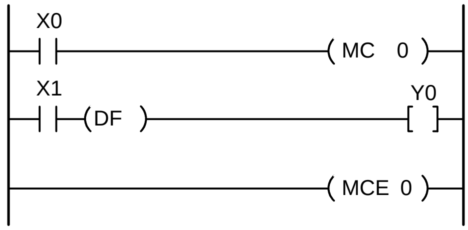
8.5.3 Precautions When Using a Control Instruction

Instructions which leading edge detection compare the condition of the previous execution and the condition of the current execution, and execute the instruction only if the previous condition was off and the current condition is on. In any other case, the instruction is not executed.

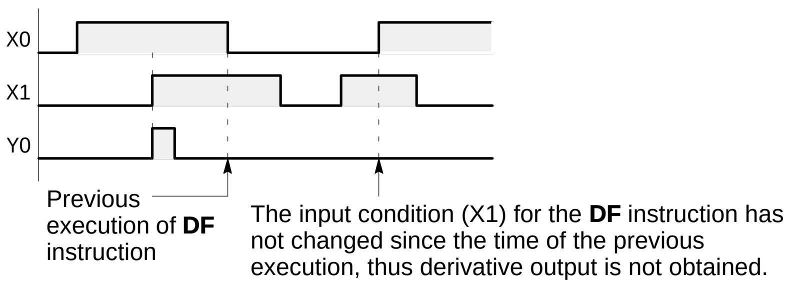
When a leading edge detection instruction is used with an instruction which changes the order of instruction execution such as **MC**, **MCE**, **JP** or **LBL**, the operation of the instruction may change as follows depending on input timing. Take care regarding this point.

Example 1:

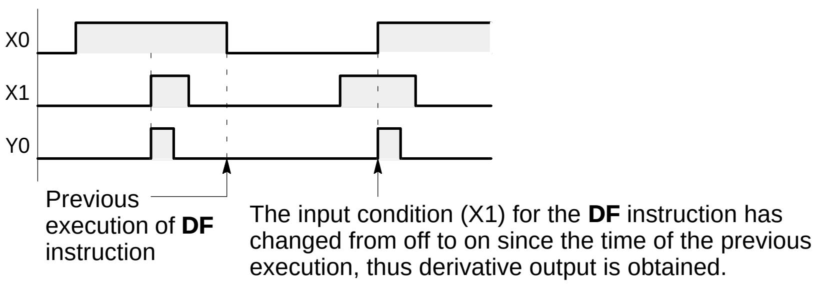
Using the DF instruction between MC and MCE instructions



Time chart 1

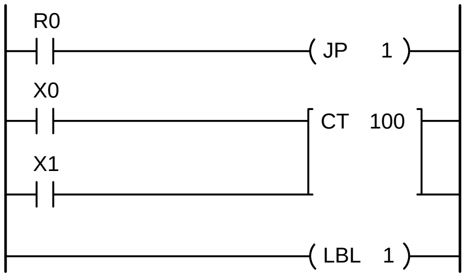


Time chart 2

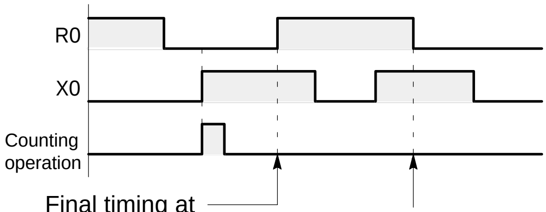


Example 2:

Using the CT instruction between JP and LBL instructions



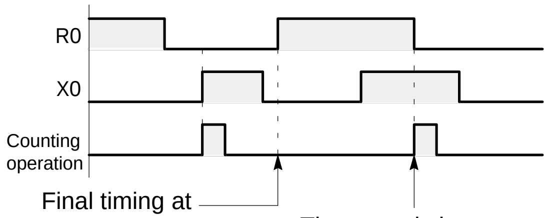
Time chart 1



Final timing at which the previous **JP** instruction was not executed

The count is not incremented, because the final timing at which the previous **JP** instruction was not executed has not been changed, and the execution condition X0 for the counter input has not changed.

Time chart 2



Final timing at which the previous **JP** instruction was not executed

The count is incremented, because the count input changed from off to on after the final timing at which the previous **JP** instruction was not executed.

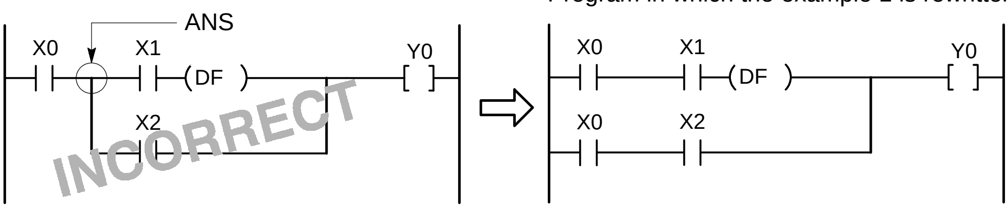
8.6 Precautions for Programming

Programs which do not execute correctly

Do not write the following programs as they will not execute correctly.

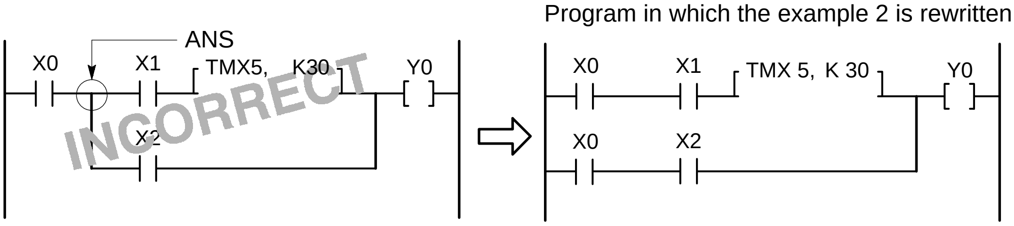
Program example 1:

Program in which the example 1 is rewritten



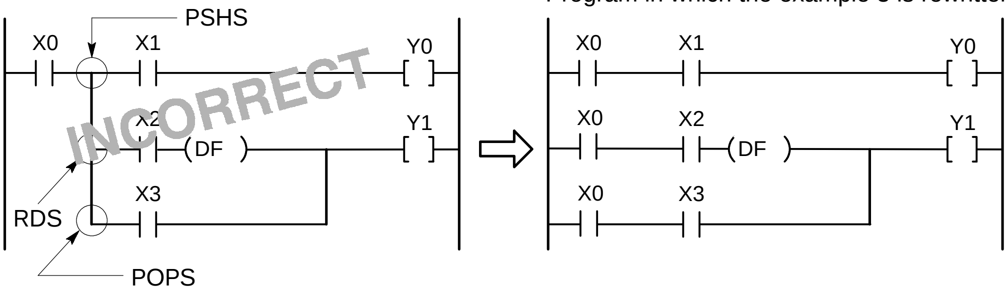
Program example 2:

Program in which the example 2 is rewritten



Program example 3:

Program in which the example 3 is rewritten



When a combination of contacts are set as the trigger (execution condition) of a differential instruction (**DF**) or timer instruction, do not use an AND stack (**ANS**) instruction, read stack (**RDS**) instruction, or pop stack (**POPS**) instruction.

8.7 Rewrite Function During RUN

8.7.1 Operation of Rewrite During RUN

How Operation of Rewrite During RUN

The FP0 allows program rewriting even in RUN mode. When a rewrite is attempted during RUN, the tool service time is temporarily extended, program rewriting is performed, and operation is resumed without the need to change the mode. For this reason, the time of the scan during the RUN rewrite extends from several msec to several hundreds of msec.

Operation During Rewrite

External output (Y) is held.

External output (X) is ignored.

The timer (T) stops the clock.

Rise and fall changes in the inputs of differential instructions (**DF**), counter instructions (**CT**), and left/right shift registers [**F119 (LRSR)**] are ignored.

Interrupt functions are stopped.

Internal clock relays (special internal relays) are also stopped.

Pulse output is stopped during the rewrite.

Set Values for Timer/Counter Instructions

All set values specified with decimal constants (K) in timer and counter instructions are preset in the corresponding set value areas (SV). Values in the elapsed value area (EV) do not change.

Operation of Rewrite During RUN Completed Flag

The rewrite during RUN completed flag (R9034) is a special internal relay that goes on for only the first scan following the completion of rewriting in the RUN mode. It can be used instead of the initial pulse relay following a change in the program. (Supported in CPU Ver. 2.0 and subsequent versions)

8.7.2 Cases Where Rewriting During Run is not Possible

Instructions which do not allow rewriting during RUN

Step ladder instructions (**SSTP/STPE**)
Subroutine instructions (**SUB/RET**)
Interrupt instructions (**INT/IRET**)
Control instructions (**ED/LBL**)
(LBL instructions allow insertion and writing, but not deletion and clearing.)

Instructions which do not allow rewriting to subprograms

The following instructions do not allow rewriting during subroutines or interrupt programs.
Jump/label instructions (**JP/LBL**)
Loop/label instructions (**LOOP/LBL**)
Master control relay/master control relay end instructions (**MC/MCE**)

Cases where rewriting is not possible during RUN

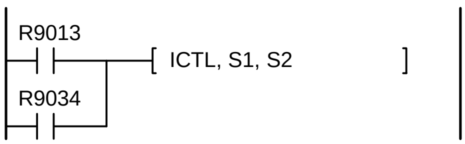
When a syntax error has occurred.
During forced input/output operation

Interrupt Restrictions

When using interrupt, high-speed counter, pulse output or PWM output functions, do not perform a rewrite during RUN.
If a rewrite during RUN is executed, the following problems may occur. Exercise caution.

Interrupt programs will be disabled. Enable by executing an **ICTL** instruction once again.

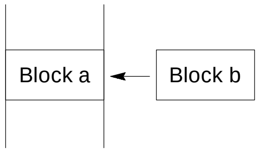
Example: Using R9034 (rewrite during RUN completed flag)



The high-speed counter will continue to count.
At 2.5 kHz or higher during one-phase, one channel counting or 1.25 Hz or higher during one-phase, two channel counting, miscounts may occur.
Target value match on/off instructions (**F166/F167**) will continue.
Coincidence programs will be disabled.

Pulse output and PWM output will be stopped. The **F168** instruction (positioning control) will continue to operate.
However, when the maximum output frequency is higher than 2.5 kHz during one-phase, one channel counting or 1.25 Hz during one-phase, two channel counting, the output pulse number may differ from the set number.

8.7.3 Procedures and Operation of Rewrite During RUN

<table>
<tr><th colspan="2">Item</th><th>FPWIN GR
Ladder symbol mode</th><th>FPWIN GR
Boolean mode</th><th>FP Programmer II</th></tr>
<tr><td colspan="2">Rewrite procedure</td><td>Maximum of 128 steps.
Changes are performed by block.
When PG conversion is executed online, the program will be rewritten.

</td><td colspan="2">Rewriting performed by step.
Caution is required as rewriting takes place simultaneously with the change.
In the case of FP Programmer II, the mode must be changed. (See section 8.7.4.)</td></tr>
<tr><td rowspan="6">Operation of each instruction</td><td>OT/KP</td><td>If an instruction written in block a is deleted in block b, the condition before the rewrite will be held.</td><td colspan="2">If an instruction written in block a is deleted in block b, the condition before the rewrite will be held.
Y contact relays which are on will be held in the on status. To turn them off in the RUN mode, use forced output.</td></tr>
<tr><td>TM/CT</td><td>If an instruction written in block a is deleted in block b, the condition before the rewrite will be held.
Set values specified by K constants in TM/CT instructions are preset in all of the corresponding SV's in the program. (Elapsed values EV do not change.)</td><td colspan="2">If an instruction written in block a is deleted in block b, the condition before the rewrite will be held.
Set values specified by K constants in TM/CT instructions are preset in all of the corresponding SV's in the program. (Elapsed values EV do not change.)
In the case of FP Programmer II, set values can be rewritten during operation without affecting the timer. For detailed information ☛ section 8.8</td></tr>
<tr><td>High-level instructions</td><td>If an instruction written in block a is deleted in block b, the condition before the rewrite will be held.</td><td colspan="2">If deleted, the output memory area will be held.</td></tr>
<tr><td>MC/MCE</td><td>When writing MC/MCE instructions, be sure to write the instructions as a pair.</td><td colspan="2">Writing or deleting a single instruction during RUN is not possible. Write or delete the instruction in FPWIN GR ladder symbol mode.</td></tr>
<tr><td>CALL/SUB/ RET</td><td>A subroutine is a program appearing between SUBn and RET instructions. Be sure to write it to an address which follows the ED instruction.</td><td colspan="2">Write in the order: RET, SUB, CALL
Delete in the order: CALL, SUB, RET</td></tr>
<tr><td>INT/IRET</td><td>An interrupt program is a program appearing between INTn and IRET instructions. Be sure to write it to an address which follows the ED instruction.</td><td colspan="2">Write in the order: IRET, INT
Delete in the order:INT, IRET</td></tr>
</table>

☛ next page

Item		FPWIN GR Ladder symbol mode	FPWIN GR Boolean mode	FP Programmer II
Operation of each instruction	**SSTP/STPE**	A distance with the same number cannot be defined twice. An **SSTP** instruction cannot be written in a subprogram.	Writing and deletion of a single instruction is not possible for a program with no step ladder area. Write or delete both instructions simultaneously in FPWIN GR ladder symbol mode. In the case of an **SSTP** instruction only, writing and deletion of a single instruction is possible for a program with a step ladder area.	
	JP/LOOP/LBL	Be sure to write the instruction for setting the loop number before **LBL-LOOP** instructions.	Write in the order: **JP-LBL** or **LOOP-LBL**. Delete in the order: **LBL-JP** or **LBL-LOOP**.	

8.7.4 Changing Modes in FP Programmer II

Changing program modes

FP Programmer II is normally in PROG-EDIT mode which does not allow unintentional rewriting of programs. To perform a rewrite during RUN, the mode must be changed to RUN-EDIT mode.

Change the mode as shown below. After the rewrite, change back to PROG-EDIT mode to prevent accidental rewriting.

Procedure for changing to RUN-EDIT mode

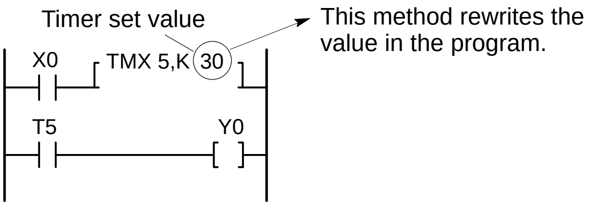
ACLR → (-) OP 1 4 → ENT → 1 → WRT

Procedure for changing to PROG-EDIT mode

ACLR → (-) OP 1 4 → ENT → 0 → WRT

8.8 Changing the Set Value of Timer/Counter During RUN

8.8.1 Method of Rewriting Constant in FP Programmer II

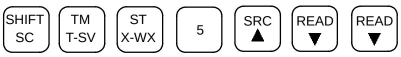


Rewrite Method Using FP Programmer II

Example of changing the set value of timer 5 from K30 to K50

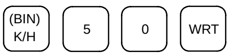
Procedure:

1. **Read the address containing the timer instruction.**



2. **Clear the constant (K30).**

3. **Enter the new constant (K50).**

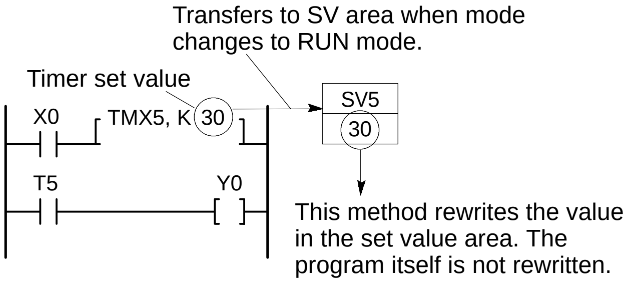


Operation and Cautions After the Change

After the change, the timer or counter in operation will continue to run. Operation based on the changed set value will be started the next time the execution condition changes from off to on.

When this method is used, the program itself will change. Thus, when the mode is changed and then set back to RUN or when the power is turned on, the changed set value will be preset.

8.8.2 Method of Rewriting a Value in the Set Value Area



Changing values in the set value area SV

Values in the set value area SV can be changed with the following procedures.

- Method using the programming tool software (FPWIN GR)
- Method using the FP Programmer II
- Method using the program (high-level instruction)

Operation and cautions after the change

After the change, the timer or counter in operation will continue to run. Operation based on the changed set value will be started the next time the execution condition changes from off to on.

With these methods, the value in the set value area SV will change, however, the program itself will not change. Therefore, when the mode is changed and then set back to RUN or when the power is turned on, operation will take place as follows:

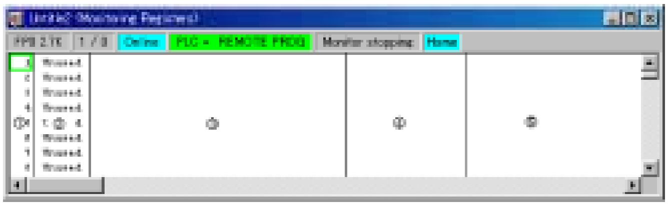
When a set value in the program is specified by a constant K
The constant K is preset in the set value area SV. After the change, it will no longer be effective.

When a set value in the program is specified by a set value area number
In the case of a non-hold type timer or counter, 0 is preset in the set value area SV. In the case of a hold type timer or counter, the value changed by the method on the following page is preset in the set value area SV.

Method 1: Method using the programming tool software

Procedure:

Select “Monitoring Registers” from the Online menu.



Explanation of each column

(1) Displays the line number.

(2) Displays the device code and device number.

(3) Displays the monitored data.
During online monitoring, you can make changes to the data by either pressing [Enter] in this column or by double clicking.

(4) Displays the base (decimal, hexadecimal, binary or ASCII) and the number of words.

(5) Displays the I/O comment for each register.
You can input I/O comments for each register by either pressing [Enter] in this column or by double clicking.

Click in each column and change the settings.
For details, please refer to the FPWIN GR help menu.

The “FPWIN GR” tool software has a similar menu.
For information on operating the menus, please check the Help menu.

Method 2: Method using the FP Programmer II

Use the word data monitor function to read the set value area SV of the timer or counter to be changed, and rewrite the value.

Example of changing the value of SV0 from K30 to K50.

Procedure:

1. **Execute word data monitor (OP8).**

   (-) OP | 8 | ENT

2. **Read SV0.**

   TM T-SV | 0 | READ ▼

3. **Clear SV0.**

   (HELP) CLR

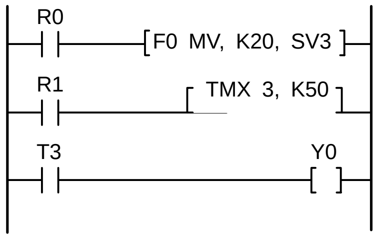
4. **Write the new changing value.**

   (BIN) K/H | 5 | 0 | WRT

Method 3: Method using the program (high-level instruction)

To change a set value of timer/counter based on an input condition, use a high-level instruction as shown below to rewrite the value in the set value area SV of the desired timer or counter.

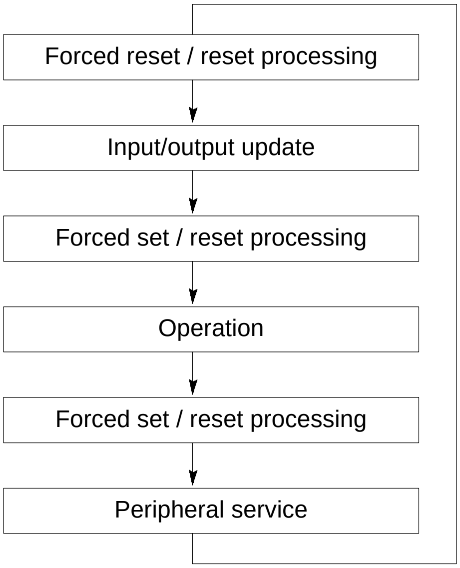
Example: Changing the set value to K20 when input R0 turns on



When R0 turns on, the timer set value changes from 5 seconds to 2 seconds.

8.9 Processing During Forced Input and Output

Processing when forced input/output is initiated during RUN



Processing of external input (X)

Regardless of the state of the input from the input device, forced on/off operation will take precedence at a contact specified for forced input/output. At this time, the input LED will not blink, however, the area of input X in the operation memory will be rewritten.
Contacts not specified will read in the on/off state according to the condition of the input from the input device.

Processing of external output (Y)

Regardless of the result of operation, forced on/off will take precedence at a contact specified for forced input/output. At this time, the area of output Y in the operation memory will be forcedly rewritten. External output will take place according to the input/output update timing in the above diagram.
The on/off state of contacts not specified will be determined by the operation result.

Timer (T) and Counter (C)

Regardless of the timer/counter input condition, forced on/off operation will take precedence at a contact specified for forced input/output. At this time, the contact of the timer (T) or counter (C) in the operation memory will be rewritten. Timing and counting will not take place during control.
The on/off state of contacts not specified will be determined by the operation result.

8.10 Setting the Clock/Calendar Timer (T32CT type only)

Ckock/Calendar timer setting area

The write area and read area for clock/calendar timer is allocated to special data registers DT90053 to DT90057.

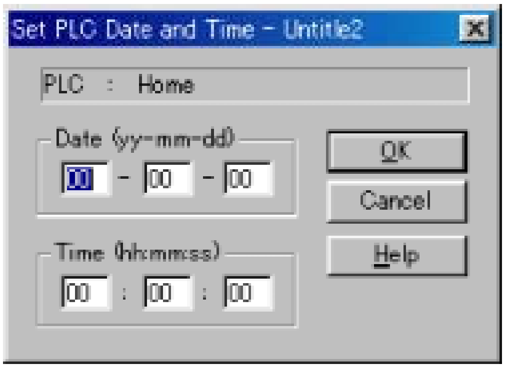
Special data register number	Upper byte	Lower byte	Read	Write
DT90053	Hour data H00 to H23	Minute data H00 to H59	Available	Not Available
DT90054	Minute data H00 to H59	Second data H00 to H59	Available	Available
DT90055	Day data H01 to H31	Hour data H00 to H23	Available	Available
DT90056	Year data H00 to H99	Month data H01 to H12	Available	Available
DT90057	- - -	Day of week data H00 to H06	Available	Available

Clock/Calendar timer setting

There are three ways to set the clock/calendar timer, as follows.

- When using the Windows version of FPWIN

1. While online, open the setting menu by selecting [Tool] and then [Set PLC Date and Time].
2. Enter the “Date” and “Time” and press [OK].



- When using DOS version software

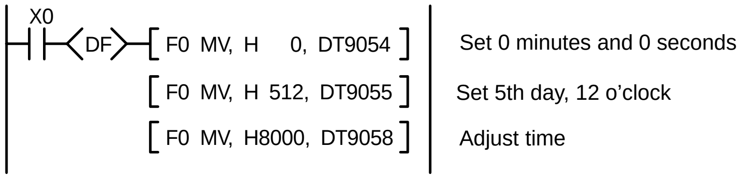
1. While online, select [Monitor] and then [Data monitor].
2. Select [Save data] (f6) and then save data registers DT90054 to DT90057.
3. Select [Write ON] (f4) and [Data write] (f7) in that order and then write a value.

- Setting and changing using a program

1. Transfer the value to be written into special data registers DT90054 to DT90057 that are allocated in clock/calendar timer setting area.
2. Write H8000 to DT90058.

Note: Execute the transfer using "P" type (derivative execution) instruction or transfer in the order of H8000 to H0000.

Example: With X0 on, adjust to the 5th day, 12:00:00.



Caution regarding backup of clock/calendar timer data

- Clock/Calendar timer values are backed up in the secondary battery.
- Do not use until the secondary battery has been sufficiently charged.
- When first used no value has been determined; therefore, please write values using a programming tool or similar.

Chapter 9

High-speed Counter/Pulse Output/ PWM Output

☛ next page

9.1 Outline of Functions

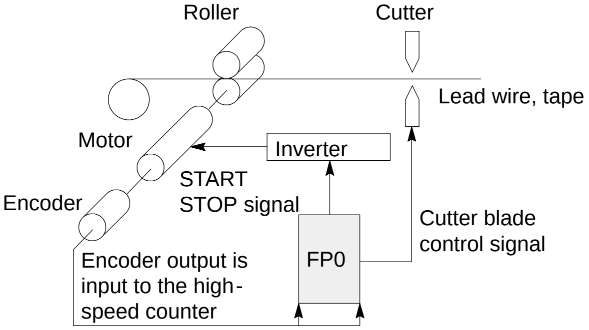
9.1.1 Three Functions that Use Built-in High-speed Counter

Functions that use the built-in high-speed counter

There are three functions available when using the high-speed counter built into the FP0.

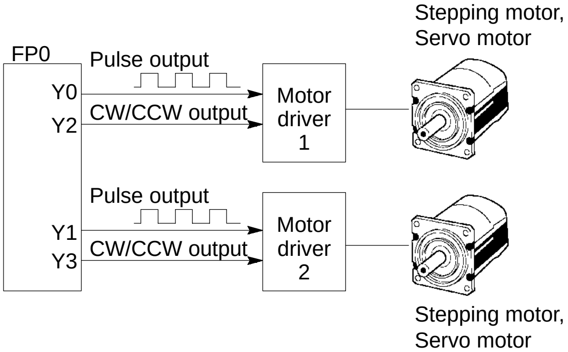
High-speed counter function

The high-speed counter function counts external inputs such as those from sensors or encoders. When the count reaches the target value, this function turns on/off the desired output.



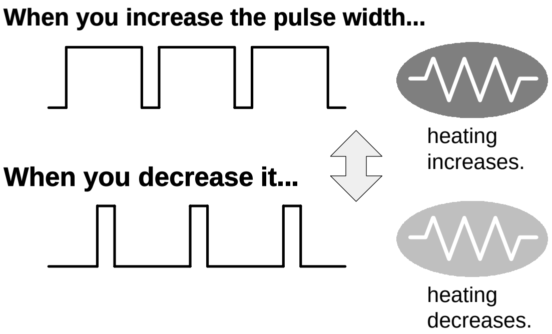
Pulse output function

Combined with a commercially available motor driver, the pulse output function enables positioning control. With the appropriate instruction, you can perform trapezoidal control, home return, and JOG operation.



PWM output function

By using the appropriate instruction, the PWM output function enables a pulse output of the desired duty ratio.



9.1.2 Performance of Built-in High-speed Counter

Channel number

There are four channels for the built-in high-speed counter.

The channel number allocated for the high-speed counter will change depending on the function being used.

Counting range

K-8388608 to K8388607
(HFF8000 to H7FFFFF)
(Coded 24-bit binary)

9.2 Specifications and Restricted Items

9.2.1 Specifications

Table of high-speed counter function specifications

Input/output contact number being used			Built-in high-speed counter channel no.	Memory area used			Performance specifications			Related instructions
On/off output	Count mode	Input contact number (value in parenthesis is reset input)		Control flag	Elapsed value area	Target value area	Minimum input pulse width	Maximum counting speed		
								Using only 1 channel	Using multiple channels	
Specify the desired output from Y0 to Y7	Incremental input, Decremental input	**X0 (X2)**	CH0	R903A	DT9044, DT9045/ DT90044, DT90045	DT9046, DT9047/ DT90046, DT90047	50 µs	Max. 10 kHz	Total of 4 CH with max. 10 kHz	**F0 (MV), F1 (DMV), F166 (HC1S), F167 (HC1R)**
		X1 (X2)	CH1	R903B	DT9048, DT9049/ DT90048, DT90049	DT9050, DT9051/ DT90050, DT90051		Max. 10 kHz		
		X3 (X5)	CH2	R903C	DT9104, DT9105/ DT90104, DT90105	DT9106, DT9107/ DT90106, DT90107	100 µs	Max. 5 kHz		
		X4 (X5)	CH3	R903D	DT9108, DT9109/ DT90108, DT90109	DT9110, DT9111/ DT90110, DT90111		Max. 5 kHz		
Specify the desired output from Y0 to Y7	2-phase input, Incremental/ decremental input, Directional distinction	**X0 X1 (X2)**	CH0	R903A	DT9044, DT9045/ DT90044, DT90045	DT9046, DT9047/ DT90046, DT90047	250 µs	Max. 2 kHz	Total of 2 CH with max. 2 kHz	
		X3 X4 (X5)	CH2	R903C	DT9104, DT9105/ DT90104, DT90105	DT9106, DT9107/ DT90106, DT90107	500 µs	Max. 1 kHz		

Note

Reset input X2 can be set to either CH0 or CH1. Reset input X5 can be set to either CH2 or CH3.

Table of pulse output function specifications

Input/output contact number being used				Built-in high-speed counter channel no.	Memory area used			Performance specifications for maximum output frequency	Related instructions
Pulse output	Directional output	Home input	Near home input		Control flag	Elapsed value area	Target value area		
Y0	**Y2**	**X0**	**DT9052/ DT90052 <bit2>**	CH0	R903A	DT9044, DT9045/ DT90044, DT90045	DT9046, DT9047/ DT90046, DT90047	Max. 10 kHz for 1-point output Max. 5 kHz for 2-point output	**F0 (MV), F1 (DMV), F168 (SPD1), F169 (PLS)**
Y1	**Y3**	**X1**	**DT9052/ DT90052 <bit6>**	CH1	R903B	DT9048, DT9049/ DT90048, DT90049	DT9050, DT9051/ DT90050, DT90051		

Note

The maximum 1-point output for instruction F168 (SPD1) is 9.5 kHz.

Table of PWM output specifications

Output number being used	Built-in high-speed counter channel no.	Memory area used	Performance specifications for output frequency	Related instructions
		Control flag		
Y0	CH0	R903A	Frequency: 0.15 Hz to 38 Hz (CPU ver. 2.0 or later: 100 to 1 kHz) Duty: 0.1 % to 99.9 %	**F0 (MV), F1 (DMV), F170 (PWM)**
Y1	CH1	R903B		

9.2.2 Functions and Restrictions

Channel

The same channel cannot be used by more than one function.

Example of prohibited application:

You cannot share CH0 with the high-speed counter and pulse output functions.

I/O number (input/output contact point)

The number allocated to each function cannot be used for normal input or outputs.

Example of prohibited application

When using CH0 for 2-phase inputting with the high-speed counter function, you cannot allot X0 and X1 to normal inputs.

When using Y0 for the pulse output function, you cannot allot origin input X0 to a normal input.

When using Y0 for the pulse output (with directional output operating) function, you cannot allot Y2 (directional output) to a normal input or output.

When using the high-speed counter with a mode that does not use the reset input, you can allot the inputs listed in parenthesis in the specifications table to a normal input.

Example of allowable application

When using the high-speed counter with no reset input and 2-phase input, you can allot X2 to a normal input.

Restrictions on the execution of related instructions (F166 to F170)

When any of the instructions related to the high-speed counter (**F166** to **F170**) are executed, the control flag (special internal relay: R903A to R903D) corresponding to the used channel turns on.

When the flag for a channel turns on, another instruction cannot be executed using that same channel.

Example of prohibited application

While executing **F166** (target value match on instruction) and flag R903A is in the on state, **F167** (target value match off instruction) cannot be executed with CH0.

Restrictions for maximum counting speed/pulse output frequency

The counting speed when using the high-speed counter function will differ depending on the counting mode as shown in the table.

Example 1:

While in the incremental input mode and using the two channels CH0 and CH1, if CH0 is being used at 8 kHz, then CH1 can be used up to 2 kHz.

Example 2:

While in the 2-phase input mode and using the two channels CH0 and CH2, if CH0 is being used at 1 kHz, then CH2 can be used up to 1 kHz.

The maximum output frequency when using the pulse output function will differ depending on the output contact number as shown in the table.

Example 1:

When using either only Y0 or only Y1, the maximum output frequency is 10 kHz.

Example 2:

When using the two contacts Y0 and Y1, the maximum output frequency is 5 kHz.

When using the high-speed counter function and pulse output function, specifications will differ depending on the conditions of use.

Example:

When using one pulse output contact with a maximum output frequency of 5 kHz, the maximum counting speed of the high-speed counter being used simultaneously is 5 kHz with the incremental mode and 1 kHz with the 2-phase mode.

9.3 High-speed Counter Function

9.3.1 Outline of High-speed Counter Function

High-speed counter function

The high-speed counter function counts the input signals, and when the count reaches the target value, turns on and off the desired output.

The high-speed counter function is able to count high-speed pulses of frequencies up to 10 kHz.

To turn on an output when the target value is matched, use the target value match on instruction (**F166**). To turn off an output, use the target value match off instruction (**F167**).

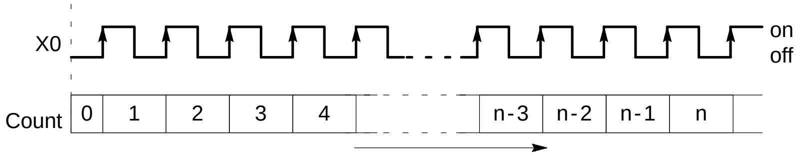
Preset the output to be turned on and off with the **SET/RET** instruction.

Setting the system register

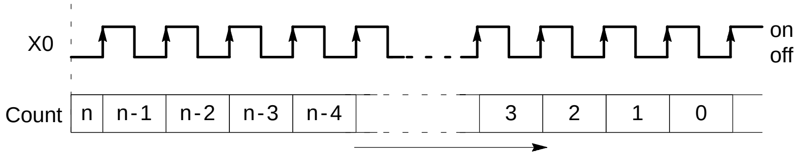
In order to use the high-speed counter function, it is necessary to set system registers 400 and 401. For detailed information ☛ section 12.4

9.3.2 Types of Input Modes

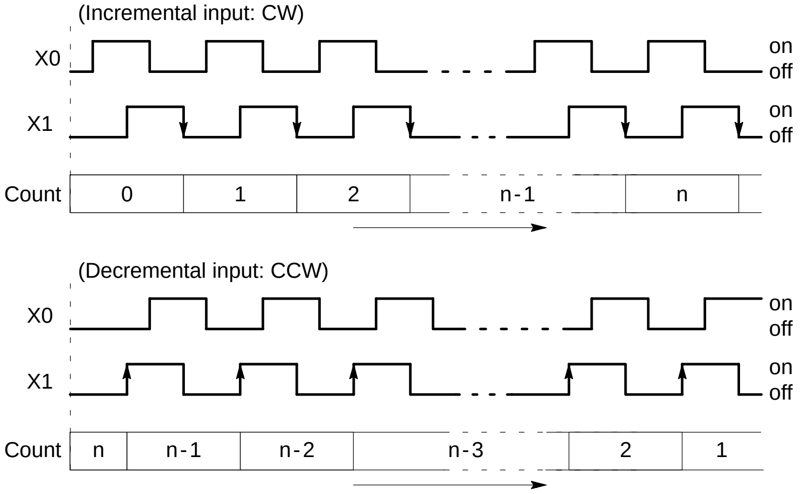
Incremental input mode



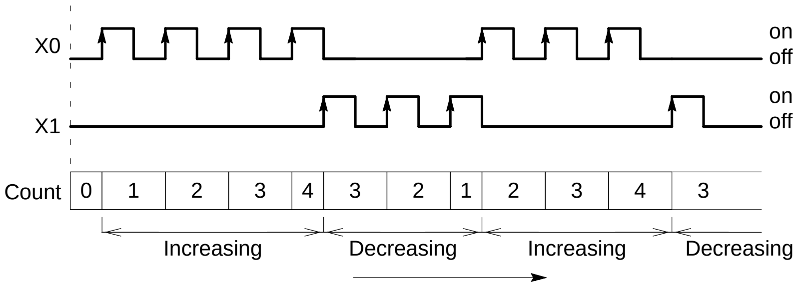
Decremental input mode



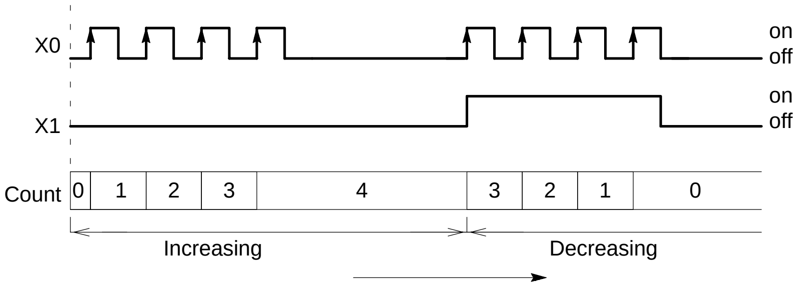
2-phase input mode



Incremental/decremental input mode (separate input mode)



Directional distinction mode

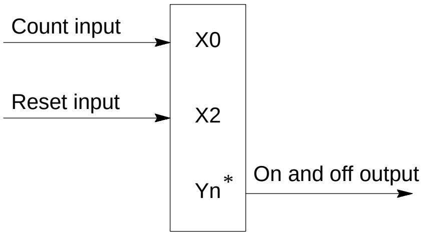


9.3.3 I/O Allocation

The inputting, as shown in the table on section 9.2.1, will differ depending on the channel number being used.

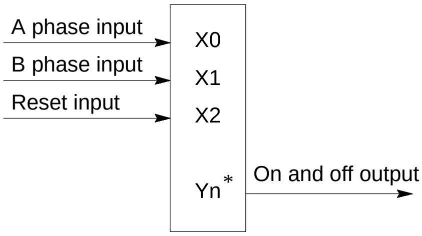
The output turned on and off can be specified from Y0 to Y7 as desired with instructions **F166** and **F167**.

When using CH0 with incremental input and reset input



* The output turned on and off when values match can be specified from Y0 to Y7 as desired.

When using CH0 with 2-phase input and reset input



* The output turned on and off when values match can be specified from Y0 to Y7 as desired.

9.3.4 Instructions Used with High-speed Counter Function

High-speed counter control instruction (F0)

This instruction is used for counter operations such as software reset and count disable.

Specify this instruction together with the **F0 (MV)** instruction and the special data register DT9052/DT90052.

Once this instruction is executed, the settings will remain until this instruction is executed again.

Operations that can be performed with this instruction

Counter software reset.

Count enable/disable.

Hardware reset enable/disable.

Clear controls from high-speed counter instructions **F166** to **F170**.

Clear target value match interrupt.

Example:

Performing a software reset

```
    X7
|--| |--(DF )--[F0 MV, H 1, DT9052 ]  |.......①
|
|               [F0 MV, H 0, DT9052 ]  |.......②
```

In the above program, the reset is performed in step ① and 0 is entered just after that in step ②. The count is now ready for operation. If it is only reset, counting will not be performed.

Elapsed value change and read instruction (F1)

This instruction changes or reads the elapsed value of the high-speed counter.

Specify this instruction together with the **F1 (DMV)** instruction and the special data register DT9044/DT90044.

The elapsed value is stored as 32-bit data in the combined area of special data registers DT9044 and DT9045/DT90044 and DT90045.

Use this **F1 (DMV)** instruction to set the elapsed value.

Example 1:

Set the initial value of K3000 in the high-speed counter (example of changing the elapsed value).

```
    X7
|--| |--(DF )--[F1 DMV, K3000, DT9044    ]  |
|                                           |
```

Example 2:

Reads the elapsed value of the high-speed counter and copies it to DT100.

```
 X7
-| |-(DF )-[F1 DMV, DT9044, DT100 ]
```

Each time the **ED** instruction is executed, the elapsed value is automatically transferred from the elapsed value area to the special data registers DT9044 and DT9045/ DT90044 and DT90045.

Target value match on instruction (F166)

```
 XA
-| |-(DF )-[F166 HC1S, K0, K10000, Y7 ]
```

If the elapsed value (DT9044 and DT9045/DT90044 and DT90045) for channel 0 matches K10000, output Y7 turns on.

```
 XB
-| |-(DF )-[F166 HC1S, K2, K20000, Y6 ]
```

If the elapsed value (DT9104 and DT9105/DT90104 and DT90105) for channel 2 matches K20000, output Y6 turns on.

Target value match off instruction (F167)

```
 XC
-| |-(DF )-[F167 HC1R, K1, K30000, Y4 ]
```

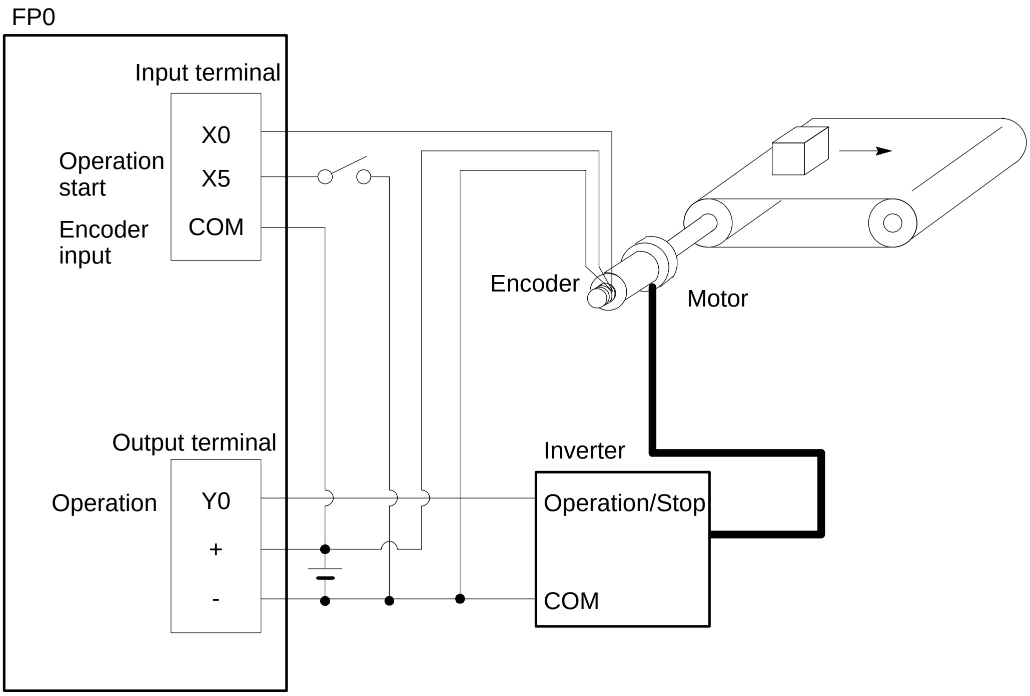
If the elapsed value (DT9048 and DT9049/DT90048 and DT90049) for channel 1 matches K30000, output Y4 turns off.

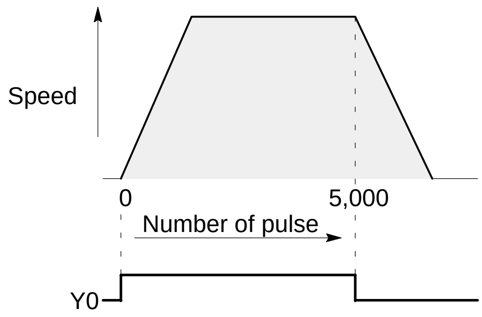
```
 XD
-| |-(DF )-[F167 HC1R, K3, K40000, Y5 ]
```

If the elapsed value (DT9108 and DT9109/DT90108 and DT90109) for channel 3 matches K40000, output Y5 turns off.

9.3.5 Sample Program

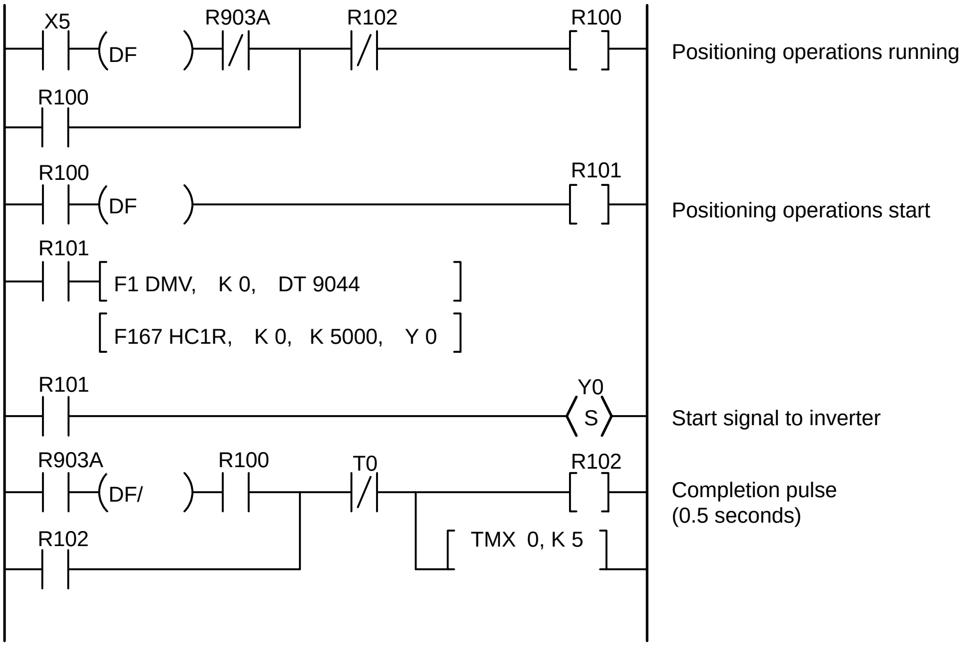
Wiring examples



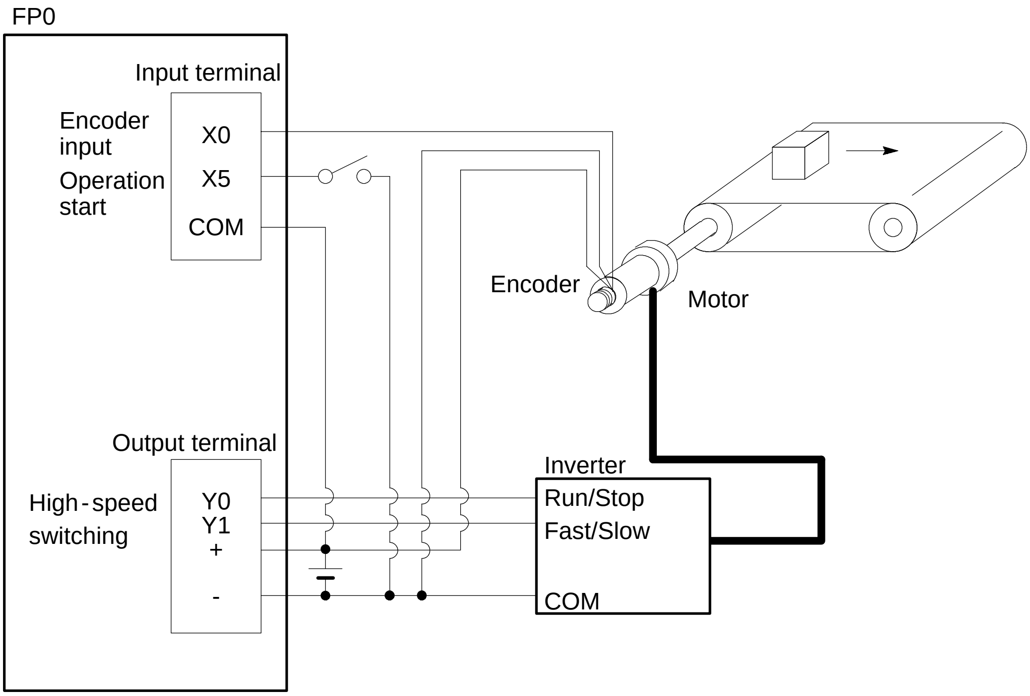


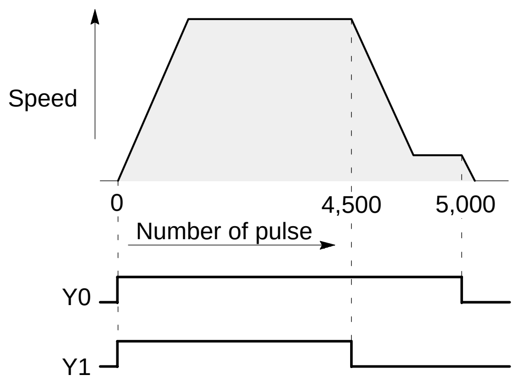
Positioning operations with a single speed inverter

When X5 is turned on, Y0 turns on and the conveyor begins moving. When the elapsed value (DT9044 and DT9045) reaches K5000, Y0 turns off and the conveyor stops.



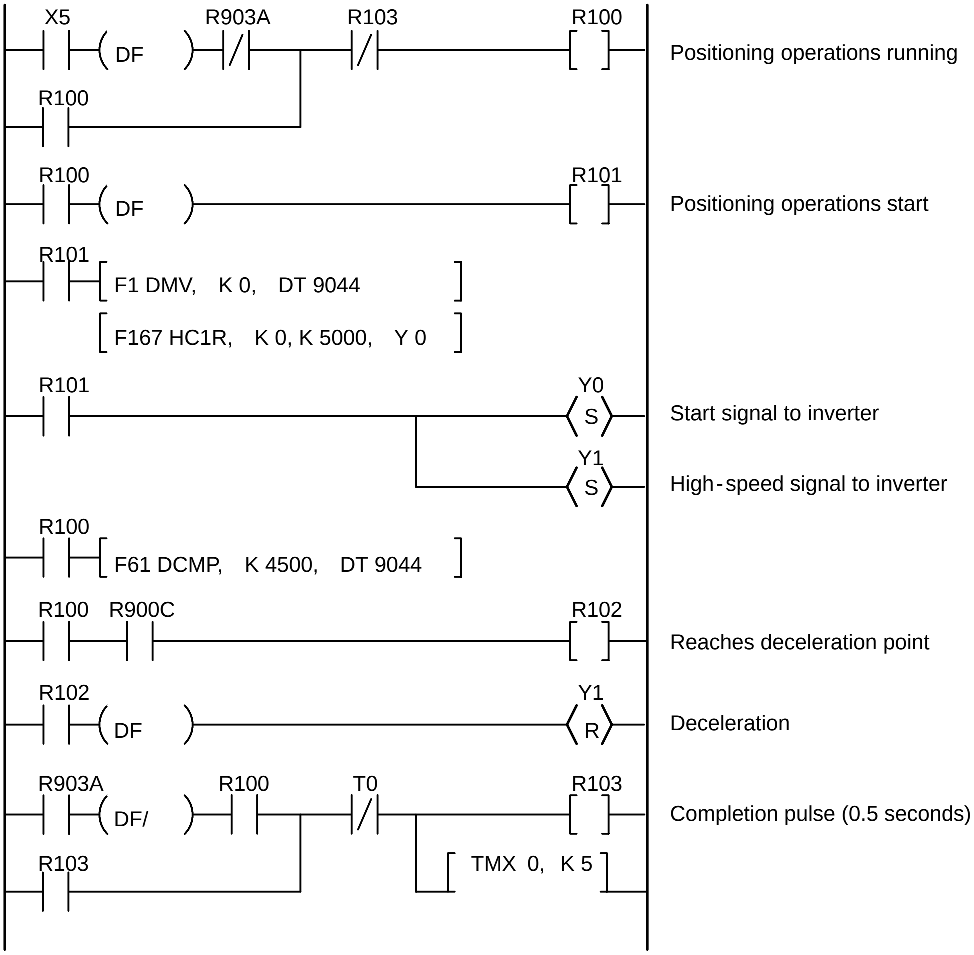
Wiring example





Positioning operations with a double speed inverter

When X5 is turned on, Y0 and Y1 turn on and the conveyor begins moving. When the elapsed value (DT9044 and DT9045) reaches K4500, Y1 turns off and the conveyor begins decelerating. When the elapsed value reaches K5000, Y0 turns off and the conveyor stops.



9.4 Pulse Output Function

9.4.1 Outline of Pulse Output Function

Instructions used and control settings

The pulse function enables positioning control by use in combination with a commercially available pulse-string input type motor driver.

Provides trapezoidal control with the instruction **F168** for automatically obtaining pulse outputs by specifying the initial speed, maximum speed, acceleration/deceleration time, and target value.

Instruction **F168** also enables automatic home return.

JOG operation with the instruction **F169** for pulse output while the execution condition (trigger) is in the on state.

Setting the system register

When using the pulse output function, set the channels corresponding to system registers 400 to “Do not use high-speed counter.”

For detailed information ☛ section 12.4

9.4.2 Control Mode

Incremental <relative value control>

Outputs the pulse of the pulse number set by the target value.

By setting H02 (incremental; forward: off; reverse: on) in the control code with instruction **F168**, when the target value is positive, the directional output is turned off and the elapsed value of the high-speed counter increases. When the target value is negative, the directional output turns on and the elapsed value of the high-speed counter decreases. By setting H03 in the control code, the directional output is the reverse of that above.

For detailed information ☛ **F168 (SPD1)** and section 9.4.5

Absolute <absolute value control>

Outputs the pulse set by the difference between the current value and the target value. (The difference between the current value and the target value is the output pulse number.)

By setting H12 (absolute; forward: off; reverse: on) in the control code with instruction **F168**, when the current value is less than the target value, the directional output is turned off and the elapsed value of the high-speed counter increases. When the current value is greater than the target value, the directional output turns on and the elapsed value of the high-speed counter decreases. By setting H13 in the control code, the directional output is the reverse of that above.

For detailed information ☛ **F168 (SPD1)** and section 9.4.5

Home return

Until the home input (X0 or X1) is entered by executing instruction **F168**, the pulse is continuously output.

To decelerate the movement when near the home, set the bit corresponding to DT9052/ DT90052 to off → on → off → with the near home input.

For detailed information ☛ **F0 (MV)**, **F168 (SPD1)** and section 9.4.5

JOG operation

Pulses are output from the specified channel while the trigger for instruction **F169** is in the on state.

The directional output and output frequency are specified by instruction **F169**.

For detailed information ☛ **F169 (PLS)** and section 9.4.5

9.4.3 I/O Allocation and Wiring

Single pulse input driver (pulse input and directional switching input)

One output point is used as a pulse output and the other output is used as a directional output.

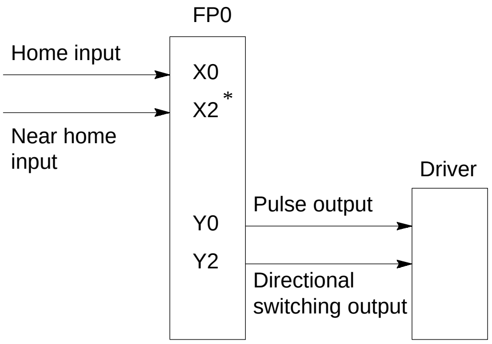
The pulse output terminal, directional output terminal, and home input I/O allocation is determined by the channel used. For detailed information ☛ section 9.2.1

Near home input is substituted by allocating the desired contact point and turning on and off the specified bit of DT9052/DT90052.

For detailed information ☛ **F0 (MV)**

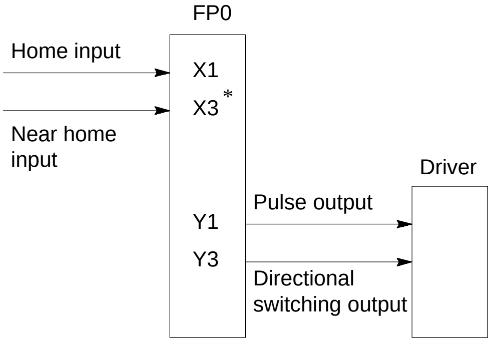
Up to two driver systems can be connected.

When using CH0



* The near home input specifies the desired input, such as X2.

When using CH1



* The near home input specifies the desired input, such as X3.

Double pulse input driver (CW pulse input and CCW pulse input)

Since a double pulse input is used, switching must be performed by an external relay.

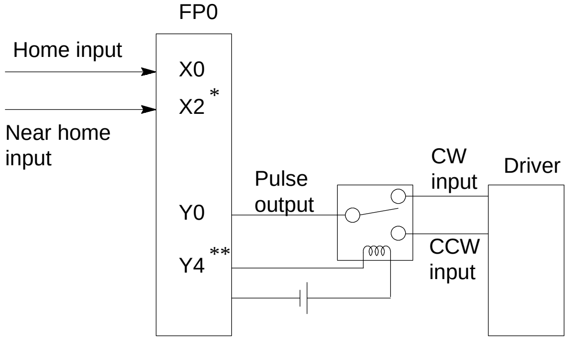
One output contact is used as a pulse output for relay switching.

The pulse output terminal and home input I/O allocation is determined by the channel used. For detailed information ☛ section 9.2.1

Set the control code for instruction **F168** to “No directional output.”

For detailed information ☛ **F168 (SPFD1)**

When using CH0

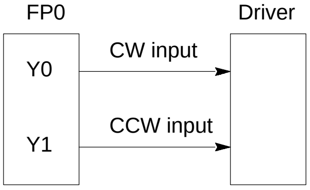


* X2 or other desired input can be specified for the near home input.

** Y4 or other desired output can be specified for the relay switching. At this time, the relay must be switched earlier by the amount of its operation time.

Caution when using a double pulse input driver

When using the FP0 pulse outputs Y0 and Y1 for direct connection to the CW input and CCW input of a driver, the counter elapsed values for the separate channels (ch0 and ch1) increase and decrease in response to the individual outputs. The elapsed values can thus be sent to the program as necessary.



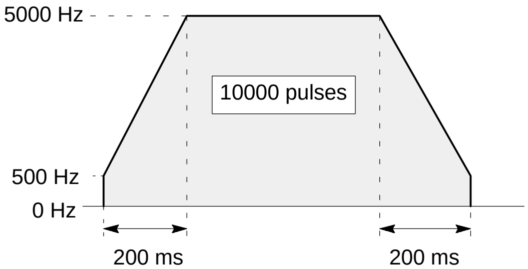
9.4.4 Instructions Used with Pulse Output Function

Positioning control instruction (F168)

Automatically performs trapezoidal control according to the specified data table.

```
 X3
─┤ ├─(DF )─[ F0 MV, H102, DT100     ]
           [ F0 MV, K500, DT101     ]
           [ F0 MV, K5000, DT102    ]
           [ F0 MV, K200, DT103     ]
           [ F1 DMV, K10000, DT104  ]
           [ F0 MV, K0, DT106       ]
           [ F168 SPD1, DT100, H0   ]
```

Generates a pulse from output Y0 at an initial speed of 500 Hz, a maximum speed of 5000 Hz, an acceleration/deceleration time of 200 ms, and a movement amount of 10000 pulses.



At this time the high-speed counter elapsed value (DT9044 and DT9045/DT90044 and DT90045) will be increasing.

Notes

- **For trapezoidal control, set the initial speed to no more than 5000 Hz.**
- **For details on troubleshooting procedures when no pulse is output when instruction F168 (SPD1) is executed, refer to page 9 - 32.**

Pulse output instruction (F169)

This instruction is for JOG operation by obtaining a pulse from the desired output when the execution condition (trigger) turns on.

```
  X2
--| |----[ F0 MV, H112, DT200      ]
         [ F0 MV, K300, DT201      ]
         [ F169 PLS, DT200, H0     ]
```

While X2 is in the on state, a pulse of 300 Hz with a duty ratio of 10% is output from Y0. At this time, directional output (Y2) is off and the count of the elapsed value for the high-speed counter CH0 (DT9044 and DT9045/DT90044 and DT90045) increases.

```
  X6
--| |----[ F0 MV, H123, DT200      ]
         [ F0 MV, K700, DT201      ]
         [ F169 PLS, DT200, H1     ]
```

While X6 is in the on state, a pulse of 700 Hz with a duty ratio of 10% is output from Y1. At this time, directional output (Y3) is off and the count of the elapsed value for the high-speed counter CH1 (DT9048 and DT9049/DT90048 and DT90049) decreases.

High-speed counter control instruction (F0)

This instruction is used for resetting the built-in high-speed counter, stopping the pulse outputs, and setting and resetting the near home input.

Specify this instruction together with the **F0 (MV)** instruction and the special data register DT9052/DT90052.

Once this instruction is executed, the settings will remain until this instruction is executed again.

Operations that can be performed with this instruction

Clear controls (stopping the pulse outputs) from high-speed counter instructions **F166** to **F170**.

Near home processing for home return operations.

Example 1: Enable the near home input during home return operations and begin deceleration.

```
   X3
|--| |--( DF )--[F0 MV, H 4 , DT9052        ]|.....①
|
|                 [F0 MV, H 0 , DT9052        ]|.....②
```

In the above program, the near home input is enabled in step ① and 0 is entered just after that in step ② to perform the preset operations.

Example 2: Performing a forced stop of the pulse output.

```
   X7
|--| |--( DF )--[F0 MV, H 8 , DT9052        ]|
|
|                 [F0 MV, H 0 , DT9052        ]|
```

Elapsed value write and read instruction (F1)

This instruction is used to read the pulse number counted by the built-in high-speed counter.

Specify this instruction together with the **F1 (DMV)** instruction and the special data register DT9044/DT90044.

The elapsed value is stored as 32-bit data in the combined area of special data registers DT9044 and DT9045/DT90044 and DT90045.

Use this **F1 (DMV)** instruction to set the elapsed value.

Example 1: Set the initial value of K3000 in the high-speed counter (example of writing the elapsed value).

```
   X7
|--| |--( DF )--[F1 DMV, K3000, DT9044      ]|
|                                             |
```

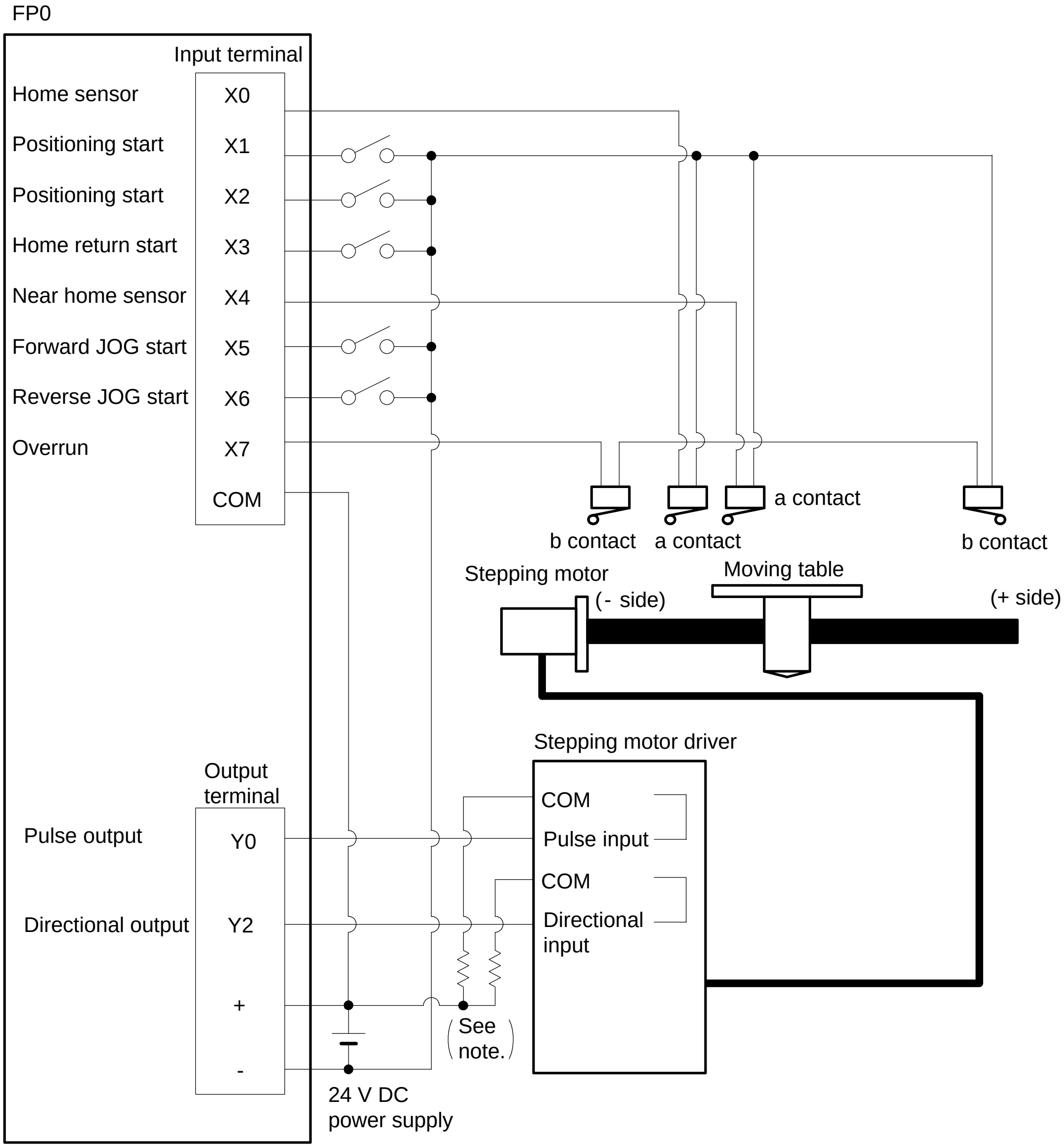
Example 2: Reads the elapsed value of the high-speed counter to DT100.

```
   X7
|--| |--( DF )--[F1 DMV, DT9044, DT100      ]|
|                                             |
```

Each time the **ED** instruction is executed, the elapsed value is automatically transferred from the elapsed value area to the special data registers DT9044 and DT9045/DT90044 and DT90045.

9.4.5 Sample Program for Positioning Control

Wiring example

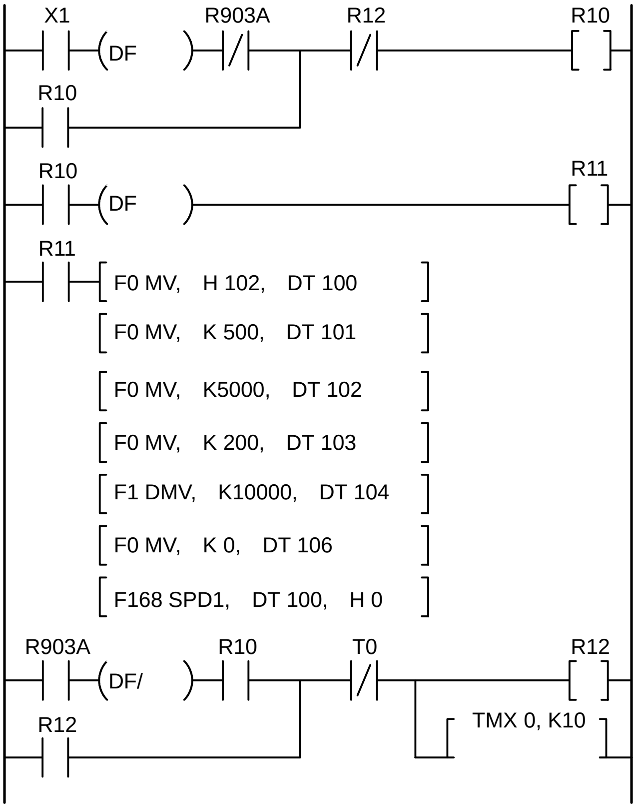


Note

When the stepping motor input is a 5 V photo-coupler type, connect a 2 KΩ 1/4 W resistor.

Relative value positioning operation (plus direction)

When X1 turns on, a pulse is output from Y0. At this time, directional output Y2 does not turn on.

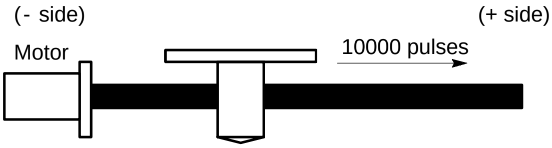


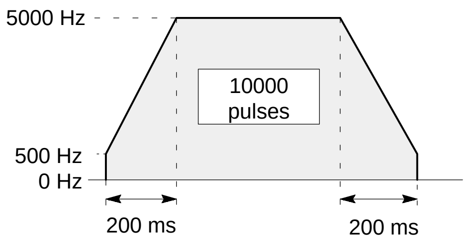
Positioning operations running

Positioning operations start

DT100	Control code: H102 [refer to “instruction **F168 (SPD1)**”]
DT101	Initial speed: 500 Hz
DT102	Maximum speed: 5000 Hz
DT103	Acceleration/deceleration time: 200 ms
DT104 DT105	Movement amount: 10000 pls
DT106	Pulse stop

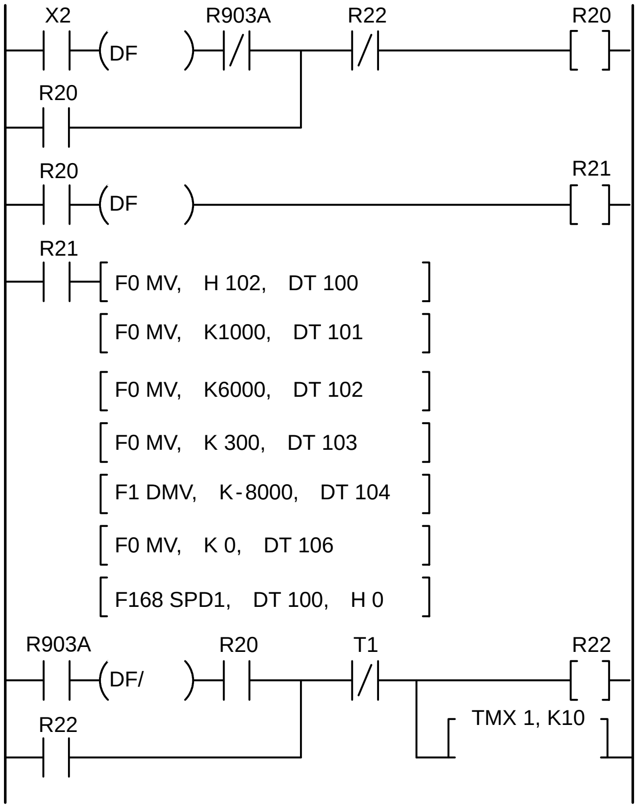
Positioning completion pulse (1 s)





Relative value positioning operation (minus direction)

When X2 turns on, a pulse is output from Y0. At this time, directional output Y2 turns on.

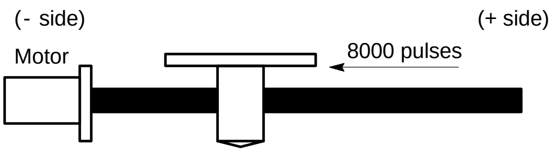


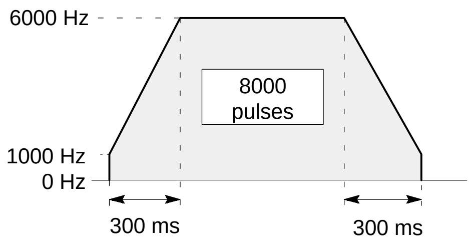
Positioning operations running

Positioning operations start

DT100	Control code: H102 [refer to "instruction **F168 (SPD1)**"]
DT101	Initial speed: 1000 Hz
DT102	Maximum speed: 6000 Hz
DT103	Acceleration/deceleration time: 300 ms
DT104 DT105	Movement amount: -8000 pls
DT106	Pulse stop

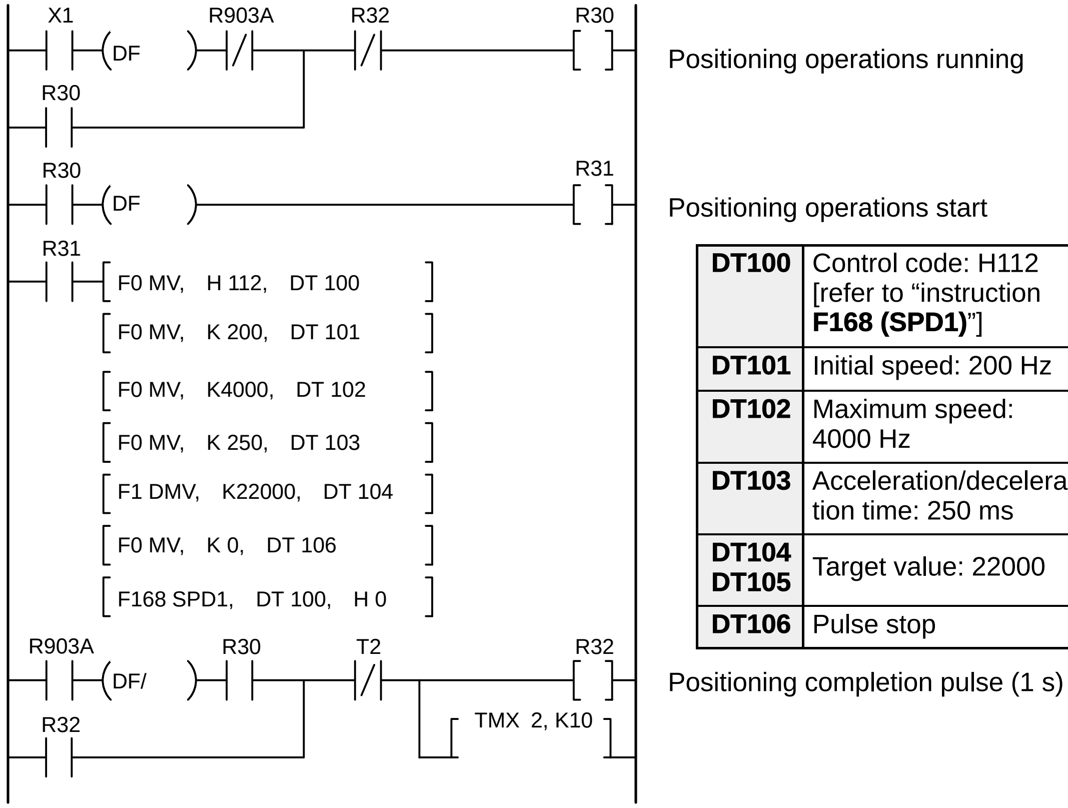
Positioning completion pulse (1 s)



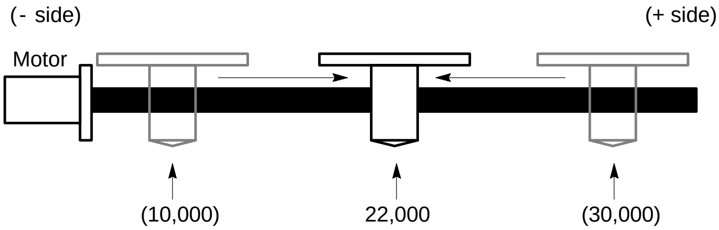


Absolute value positioning operation

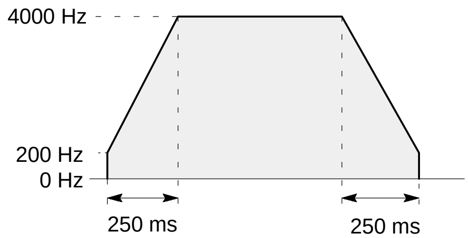
When X1 is turned on, pulses are output from Y0. If the current value at that point is larger than ”22,000”, the direction output Y2 goes on, and if the value is smaller than ”22,000”, the direction output Y2 does not go on.



DT100	Control code: H112 [refer to “instruction **F168 (SPD1)**”]
DT101	Initial speed: 200 Hz
DT102	Maximum speed: 4000 Hz
DT103	Acceleration/deceleration time: 250 ms
DT104 **DT105**	Target value: 22000
DT106	Pulse stop

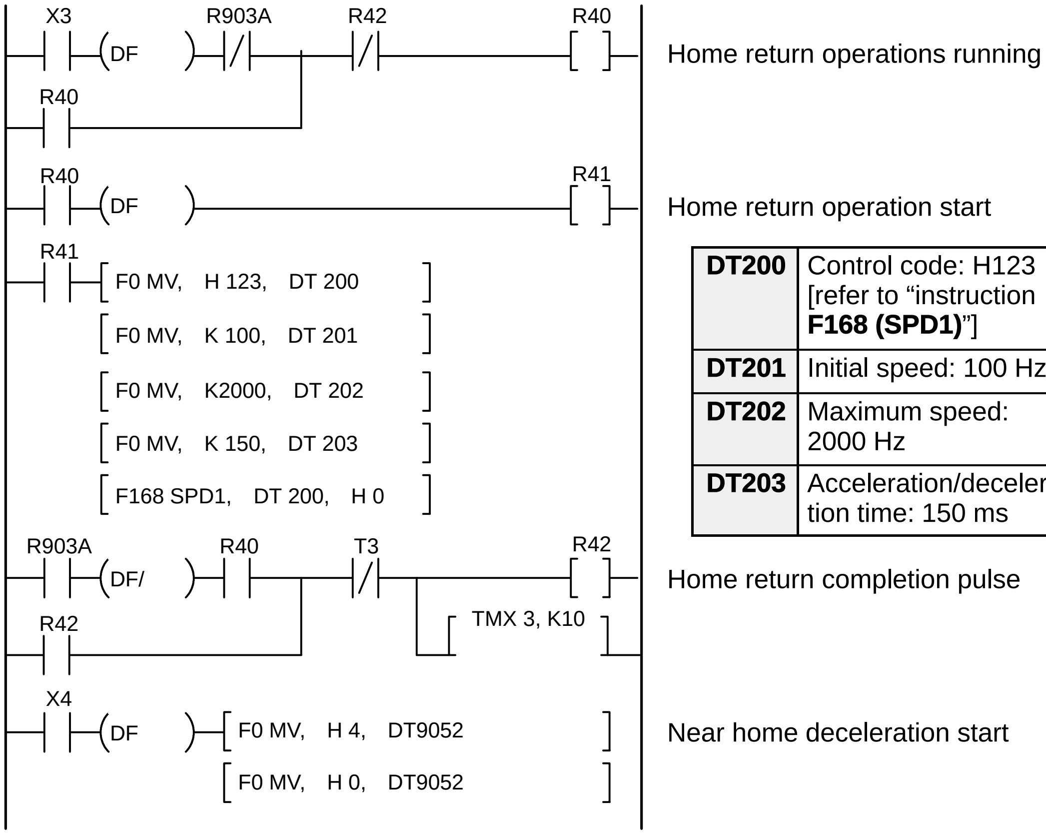


Regardless of the current value, its movement is towards position “22,000.”

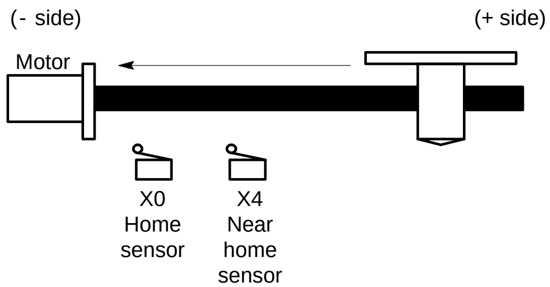


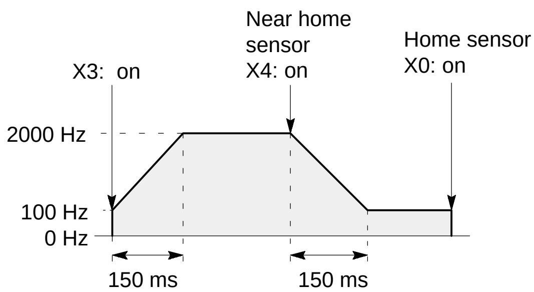
Home return operation (minus direction)

When X3 turns on, a pulse is output from Y0 and the return to home begins. At this time, directional output Y2 turns on. Then, when X4 turns on, deceleration begins, and when X0 turns on, home return is completed. After the return to home is completed, the elapsed value (DT9044 and DT9045/DT90044 and DT90045) are cleared to 0.



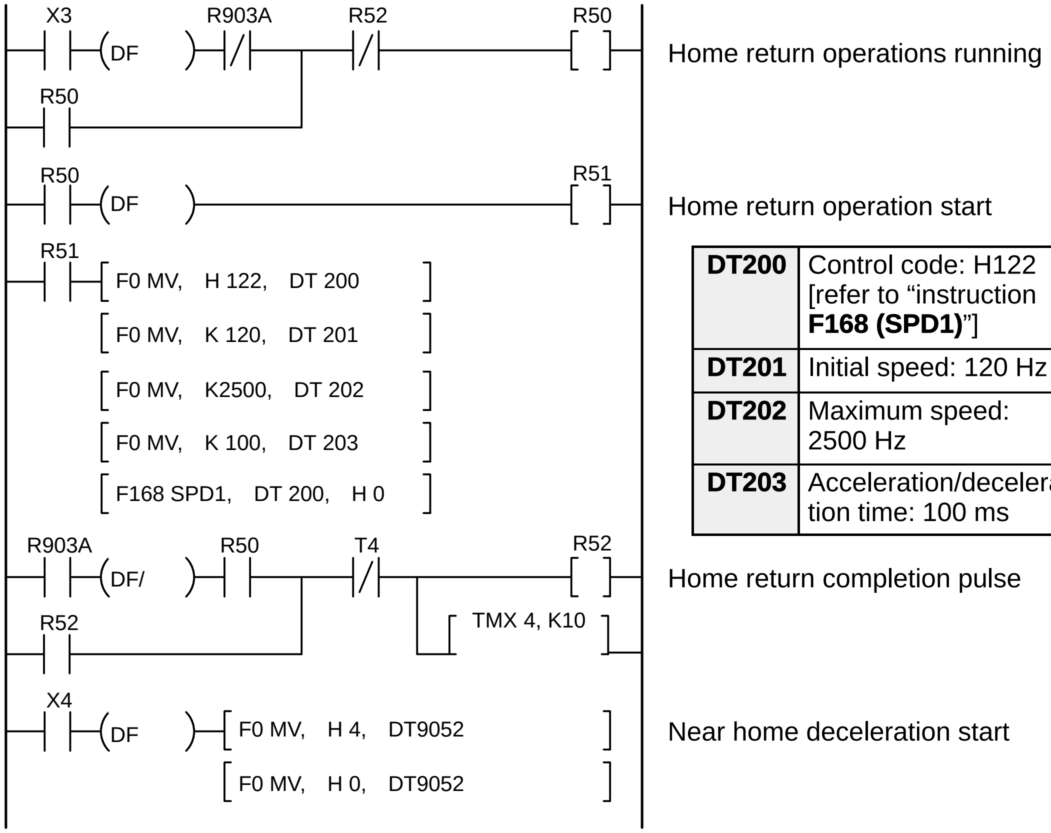
DT200	Control code: H123 [refer to "instruction **F168 (SPD1)**"]
DT201	Initial speed: 100 Hz
DT202	Maximum speed: 2000 Hz
DT203	Acceleration/decelera-tion time: 150 ms



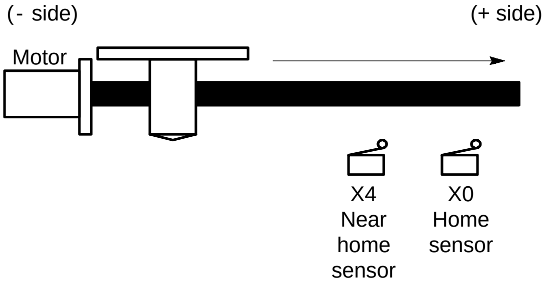


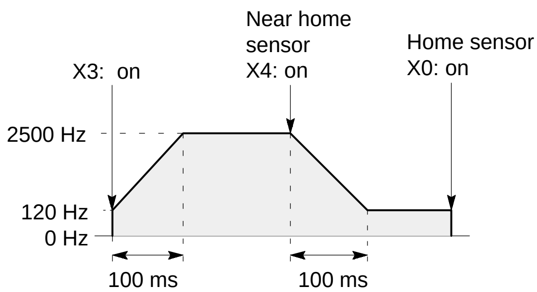
Home return operation (plus direction)

When X3 turns on, a pulse is output from Y0 and the return to home begins. At this time, directional output Y2 does not turn on. Then, when X4 turns on, deceleration begins, and when X0 turns on, home return is completed. After the return to home is completed, the elapsed value (DT9044 and DT9045/DT90044 and DT90045) are cleared to 0.



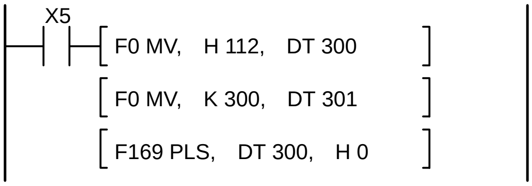
DT200	Control code: H122 [refer to “instruction **F168 (SPD1)**”]
DT201	Initial speed: 120 Hz
DT202	Maximum speed: 2500 Hz
DT203	Acceleration/deceleration time: 100 ms



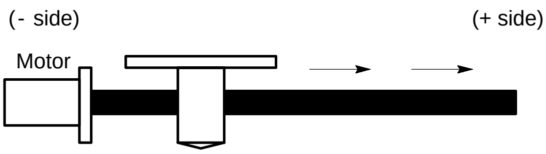


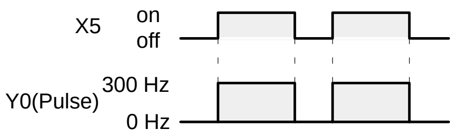
JOG operation (plus direction)

While X5 is in the on state, a pulse is output from Y0. At this time, directional output Y2 does not turn on.



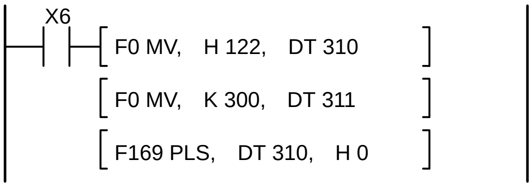
DT300	Control code: H112 [refer to “instruction **F169 (PLS)**”]
DT301	Speed: 300 Hz



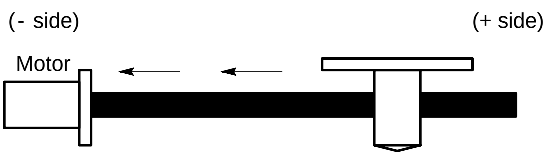


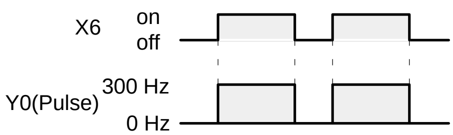
JOG operation (minus direction)

While X6 is in the on state, a pulse is output from Y0. At this time, directional output Y2 turns on.



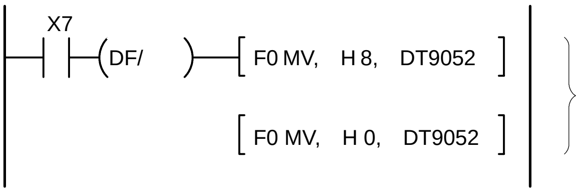
DT310	Control code: H122 [refer to “instruction **F169 (PLS)**”]
DT311	Speed: 300 Hz





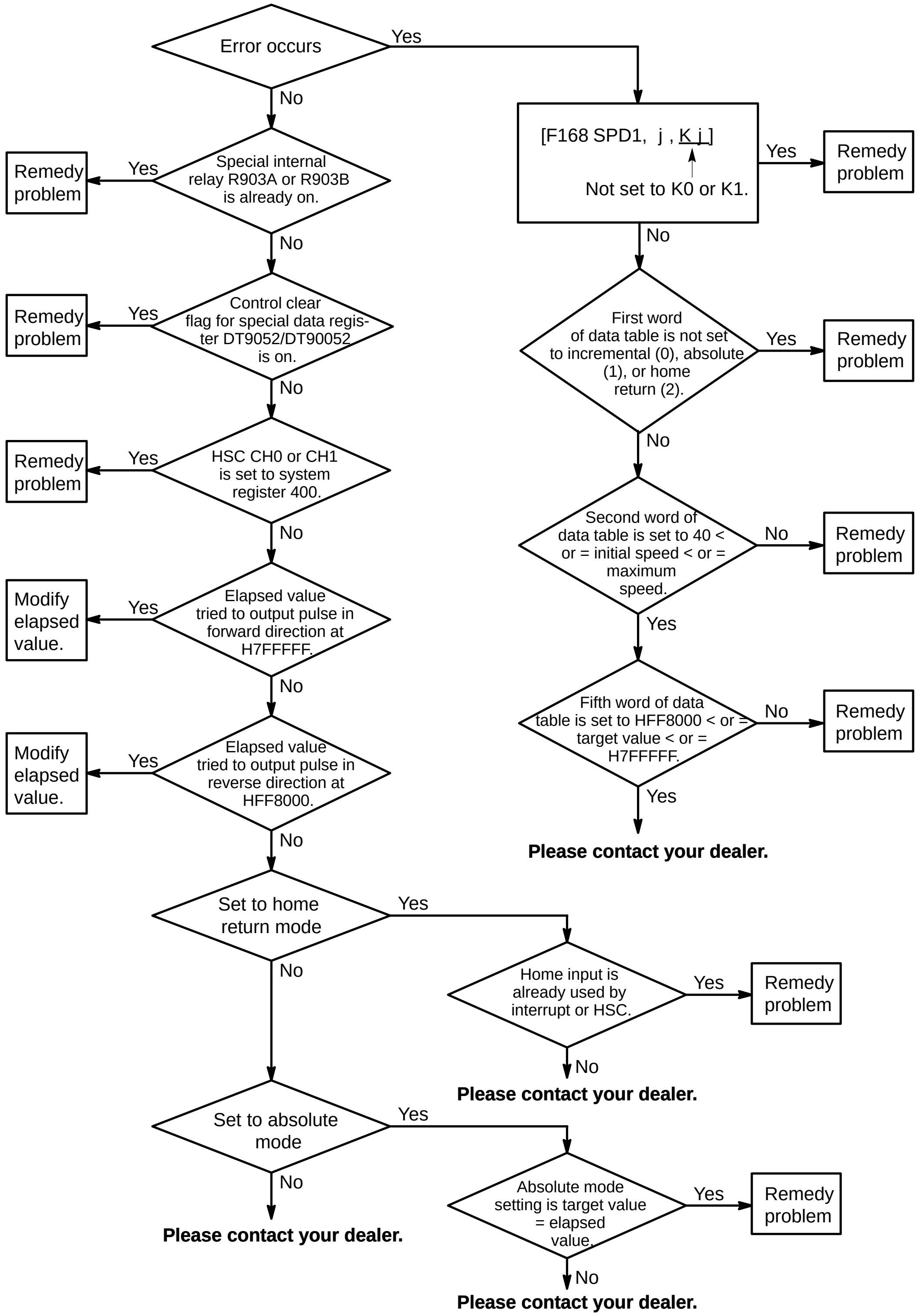
Emergency stop (over limit)

If X7 turns off while a pulse is being output from Y0, the output of the pulse is stopped.



Pulse output control clear

Troubleshooting flowchart if a pulse is not output when instruction F168 (SPD1) executed



9.5 PWM Output Function

9.5.1 Outline of PWM Output Function

PWM output function

With the instruction **F170 (PWM)**, the specified duty ratio and pulse width modulation is obtained.

Applicable to analog controls such as temperature control and light modulation.

Setting the system register

When using the PWM output function, set the channels corresponding to system registers 400 to “Do not use high-speed counter.” For detailed information ☛ section 12.4

9.5.2 Instruction Used with PWM Output Function

PWM output instruction (F170)

```
   X6
 ─┤ ├──[ F0  MV,  H5,  DT100        ]
       [ F0  MV,  K500,  DT101      ]
       [ F170  PWM,  DT100,  K0     ]
```

While X6 is in the on state, a pulse with a period of 840 ms and duty ratio of 50% is output from Y0.

```
   X7
 ─┤ ├──[ F0  MV,  H6,  DT100        ]
       [ F0  MV,  K300,  DT101      ]
       [ F170  PWM,  DT100,  K1     ]
```

While X7 is in the on state, a pulse with a period of 1.6 s and duty ratio of 30% is output from Y1.

Chapter 10

General-use Serial Communications

10.1 General-use Serial Communications Function

10.1.1 General-use Serial Communications

Using the RS232C port, data and commands can be sent to and received from an external device such as a bar code reader. This is done by executing the **F144 (TRNS)** instruction.

Transmission and reception are not enabled in the default settings, so system register 412 must be changed to a general-use port (K2).

The transmission speed (baud rate) and transmission format are set using system register 413 and 414.

10.1.2 Data Transmission

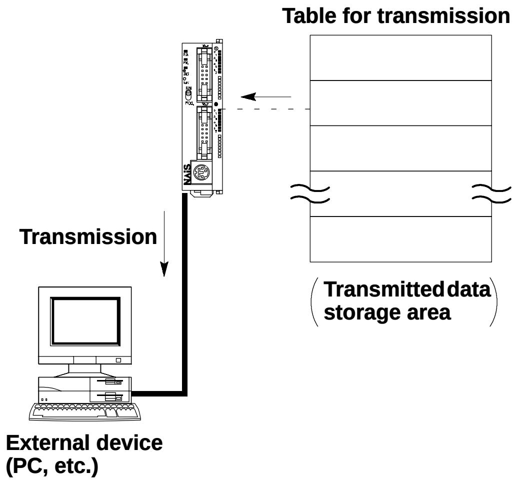
Any desired data register can be prepared as the transmission table, and the data stored in that table transmitted.

Start and terminal codes are automatically added to the data being transmitted, and the data is sent. (For details, see **"F144 (TRNS)"** instruction.)

The data register to be used as the transmission table is specified using the **F144 (TRNS)** instruction.

Data transmission is executed using the **F144 (TRNS)** instruction.

There is no restriction on the number of bytes that can be transmitted. Any number of bytes may be sent, as long as it does not exceed the range that can be used by the data register.



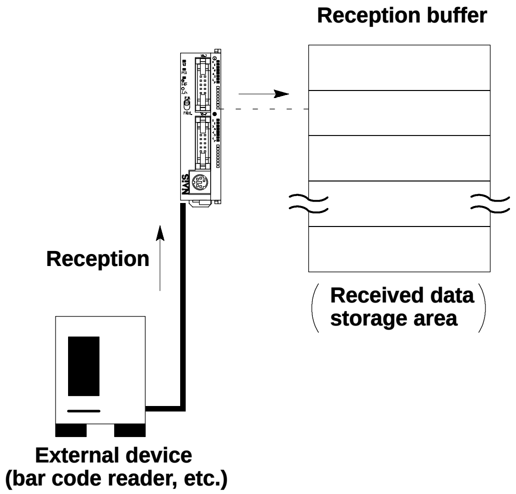
10.1.3 Data Reception

Data sent from an external device is received at the RS232C port.

The received data is automatically stored in the data register specified as the reception buffer. (For details see **“F144 (TRNS)”** instruction.)

Data registers used as reception buffers are specified by system register 417 and 418.

Data reception is enabled by the **F144 (TRNS)** instruction.



10.2 System Register Settings

Preparation for Sending and Receiving Data (System Register Settings)

Communication is not enabled in the default settings for the RS232C port. To enable communication, the items outlined below must be specified, using the system registers.

- Usage purpose of the RS232C port
- RS232C transmission format
- Baud rate
- Reception buffer

Setting the Usage Purpose of the RS232C Port (System Register 412)

Specify “General-use port” (this is K2 for the FP Programmer II). This is the setting which enables serial communication.

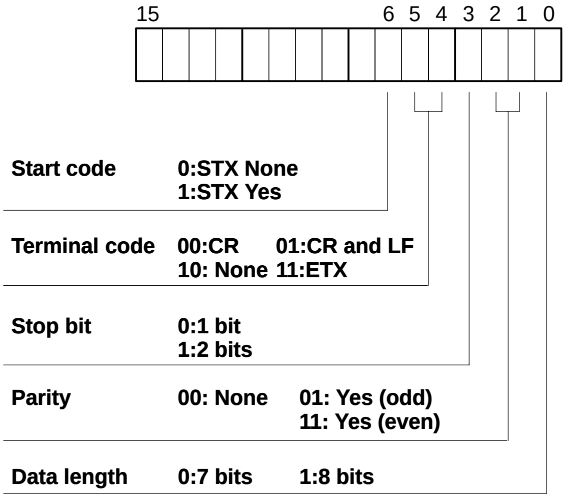
Setting the RS232C Transmission Format (System Register 413)

The transmission format is as follows in the default settings. (With the FP Programmer II, this is H3.)

Data length: 8 bits
Parity check: Yes/odd
Stop bit: 1 bit
Terminal code: CR
Start code: STX None

Set these items to match the external device connected to the RS232C port, and if changing the transmission format, enter settings for the pertinent individual items.

With the FP Programmer II, the various items should be selected in bit units, as shown below, and settings entered using H constants.



☛ next page

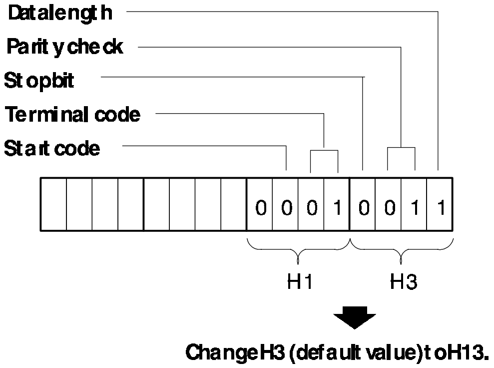
Start codes (STX) and terminal codes (EXT)

When data is transmitted, the specified code is added automatically to the data being sent. When receiving data, if ”Yes” has been specified for the start code parameter, data following the start code is stored in the reception buffer. Also, at the point at which the terminal code is received, the reception completed flag (R9038) goes on. The start and terminal codes themselves are not stored in the reception buffer, however. For details, see section 10.3.2.

Note

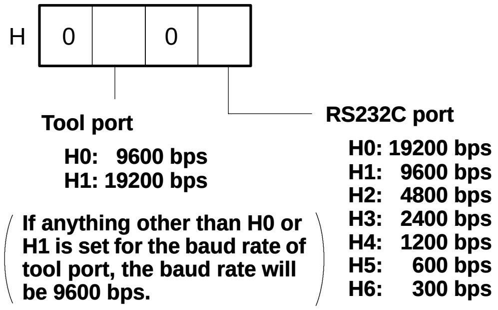
If no terminal codes are specified for either transmission or reception, the reception completed flag will not go on. In this case, watch the number of bytes received to determine whether the reception has been completed.

Example: Changing the terminal code to [CR and LF]



Setting the Baud Rate (System Register 414)

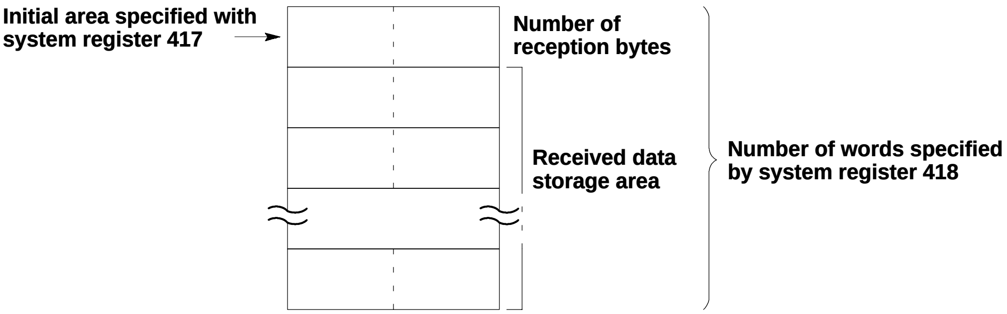
The baud rate (transmission speed) for general-use serial communication is set to “9600 bps” (H1) in the default settings.
To change this setting to match the external device connected to the RS232C port, select one of the values listed below.



Example: Setting 19,200 bps for both the tool port and RS232C port
' Write H100.

Setting the Reception Buffer (System Registers 417 and 418)

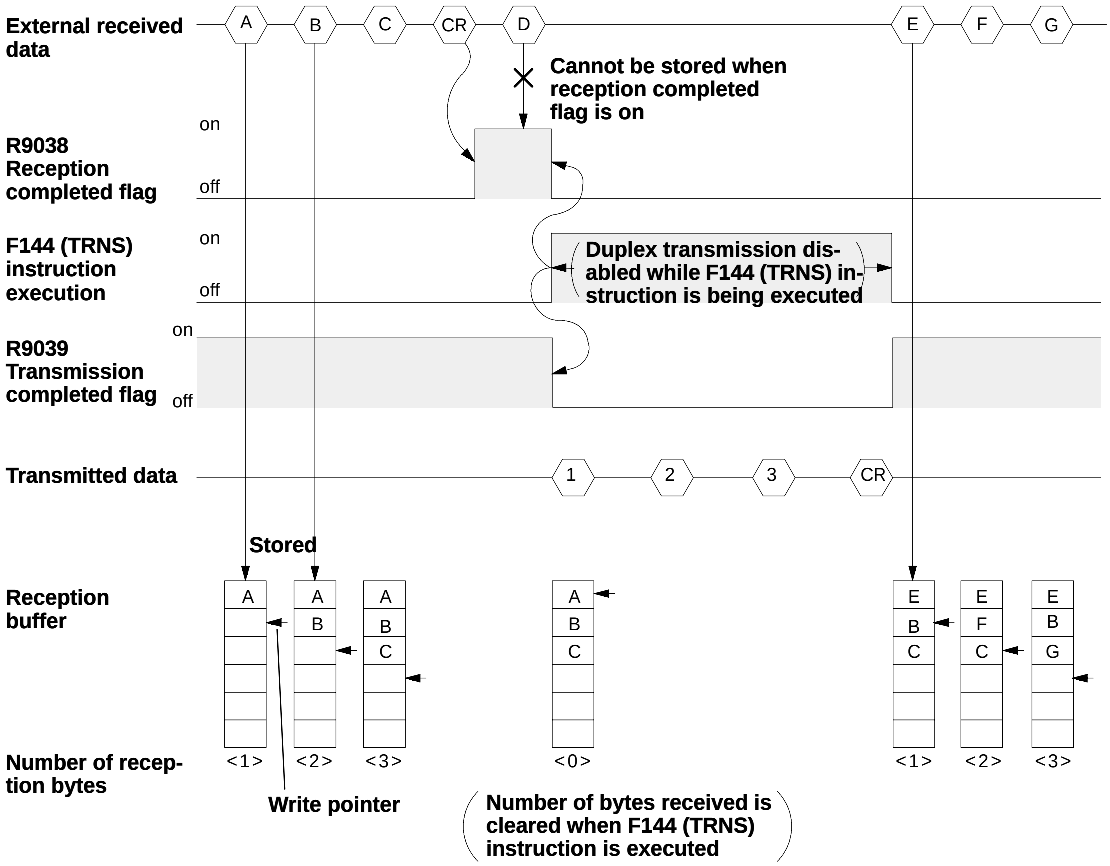
In the default settings, all areas of the data registers are set to be used as reception buffers. To change the area of the data register used as the reception buffer, specify the initial number in system register 417, and the volume (number of words) in system register 418.
The reception buffer is configured as shown below.



10.3 Operations When Using General-use Serial Communication

10.3.1 If “None” is Set for Start and Terminal Codes

Relationship between the flags (reception completed flag and transmission completed flag) and the F144 (TRNS) instruction



Half-duplex transmission should be used for general-use serial communication.

Reception is disabled when the reception completed flag (R9038) is on.

Be aware that the reception completed flag (R9038) changes even while a scan is in progress. (Example: If the reception completed flag is used multiple times as an input condition, there is a possibility of different statuses existing within the same scan.)

When the **F144 (TRNS)** instruction is executed, the error flag (R9037), reception completed flag (R9038) and transmission completed flag (R9039) go off.

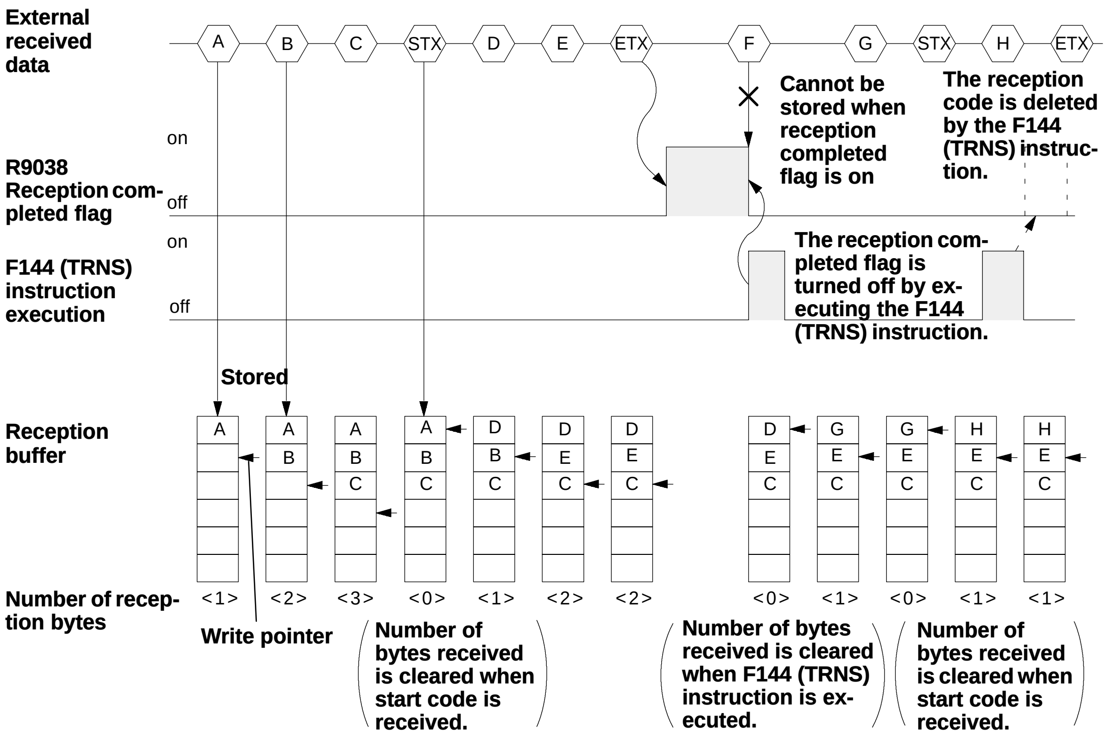
Duplex transmission is disabled while the **F144 (TRNS)** instruction is being executed. Check the transmission completed flag (R9039) to determine whether duplex transmission is possible.

When the **F144 (TRNS)** instruction is executed, the number of bytes received is cleared, and the address (write pointer) returns to the initial address in the reception buffer.

Reception stops if the error flag (R9037) goes on. To resume reception, execute the **F144 (TRNS)** instruction. This turns off the error flag, and transmits both actual and empty data.

10.3.2 If "Yes" has been Set for the Start and Terminal Codes (Start Code: STX, Terminal Code: ETX)

When receiving data



The data is stored in the reception buffer in sequential order, but at the point at which the start code is received, the number of bytes received is cleared, and the address (write pointer) is returned to the initial address in the reception buffer.

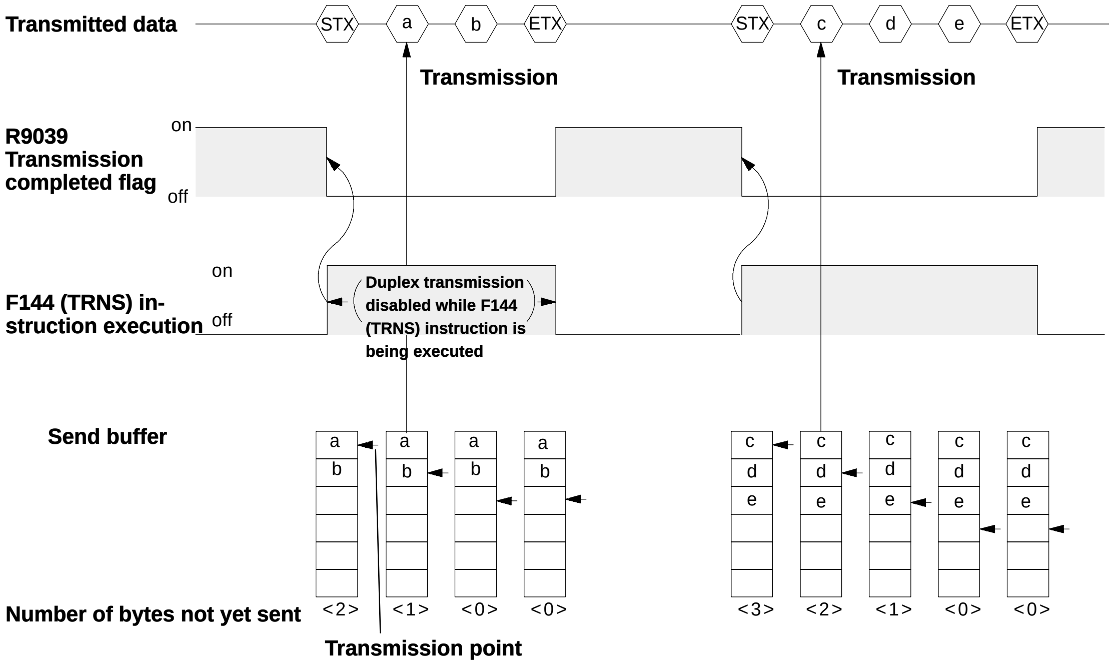
When the **F144 (TRNS)** instruction is executed, the number of bytes received is cleared, and the address (write pointer) is returned to the initial address in the reception buffer.

If there are two start codes, data following the later start code is overwritten and stored in the reception buffer.

Reception is disabled while the reception completed flag (R9038) is on.

The reception completed flag (R9038) is turned off by the **F144 (TRNS)** instruction. Because of this, if the **F144 (TRNS)** instruction is executed at the same time that the terminal code is received, the reception completed flag will not be detected.

When sending data



Start codes (STX) and terminal codes (ETX) are automatically added to the data being transmitted, and the data is transmitted to an external device. (For information on start and terminal code settings, see section 10.2.)

Executing the **F144 (TRNS)** instruction turns off the transmission completed flag (R9039).

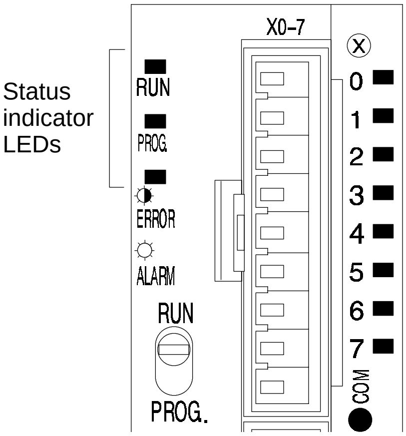
Duplex transmission is disabled while the **F144 (TRNS)** instruction is being executed. Check the transmission completed flag (R9039) to determine whether duplex transmission is possible.

Chapter 11

Self-Diagnostic and Troubleshooting

11.1 Self-Diagnostic Function

The FP0 control unit has a self-diagnostic function which identifies errors and stops operation if necessary. When an error occurs, the status of the status indicator LEDs on the FP0 control unit vary, as shown in the table.



Condition	LED status			Description	Program execution status
	RUN	PROG.	ERROR/ALARM		
Normal condition	ON	OFF	OFF	Normal operation in RUN mode	Operation
	OFF	ON	OFF	Normal operation in PROG. mode	Stop
	Blink	OFF	OFF	Forcing ON/OFF in RUN mode	Operation
Abnormal condition	ON	OFF	Blink	When a self-diagnostic error occurs	Operation
	OFF	ON	Blink		Stop
	Varies	Varies	ON	When a system watchdog timer error occurs	Stop

Normally, if an error occurs, operation of FP0 stops.

The user may select whether operation is to be continued or stopped if a duplicate output error or operation error occurs, by setting the system registers. You can set the system registers with TOOL software.

11.1.1 Allowing Duplicated Output

When you change system register 20 settings (“ENAB”) using the programming software, duplicated output is not regarded as an error and the FP0 continues to operate.

11.1.2 Continuing After an Operation Error

When you change system register 26 settings (“CONT”) using the programming software, the FP0 continues to operate. In this case, even if the FP0 continues to operate, this is regarded as an error.

11.2 Troubleshooting

11.2.1 ERROR/ALARM LED is Blinking

<Condition>
The self-diagnostic error occurs.

<Procedure 1 >
Check the error code using the programming tool.

Using FPWIN GR

In the ONLINE mode, select “Monitor” from the menu bar of FPWIN GR. And then select “Status Display”. At the “PLC Error Flag” field, self-diagnostic error code is displayed.

Using FP programmer II

Press the keys on the FP programmer II as shown on the right.

ACLR (-) OP 1 1 0 ENT READ ▼

When self-diagnostic error occurs, the screen shown on the right is displayed.

```
OP-    110
FUNCTION ERR E45
```

Error code is 1 to 9

<Condition>
There is a syntax error in the program.

<Procedure 1 >
Change to PROG. mode and clear the error.

<Procedure 2>
Execute a total-check function to determine the location of the syntax error.

Refer to your software manual, for details about the total-check method.

. **next page**

Error code is 20 or higher

< Condition>
A self-diagnostic error other than a syntax error has occurred.

< Procedure 1>
Use the programming tool in PROG. mode to clear the error.

Using FPWIN GR

Click the "Clear Error" button in the status display menu described on the previous page.

Using FP programmer II

Press the keys as shown on the right. ACLR | (−) OP | 1 | 1 | 2 | ENT | SHIFT SC | (DELT) INST

Error code 43 and higher can be cleared.

- In the PROG. mode, the power supply can be turned OFF and then ON again to clear the error, but all of the contents of the operation memory except hold type data are cleared.
- An error can also be cleared by executing a self-diagnostic error set instruction **F148 (ERR)**.

< Procedure 2>
Follow the procedures described in the table of error codes (* section 12.7).

Note

When an operation error (error code 45) occurs, the address at which the error occurred is stored in special data registers DT9017 and DT9018. If this happens, monitor the address at which the error occurred before cancelling the error.

11.2.2 ERROR/ALARM LED is ON

< Condition>

The system watchdog timer has been activated and the operation of FP0 has been stopped.

< Procedure1>

Set the mode switch from RUN to PROG. and turn the power OFF and then ON.

If the ERROR/ALARM LED is turned ON again, there is probably an abnormalty in the FP0. Please contact your dealer.

If the ERROR/ALARM LED is blinked, go to section 11.2.1.

< Procedure2>

Set the mode switch from PROG. to RUN.

If the ERROR/ALARM LED is turned ON, the program execution time is too long. Check:

- if instructions such as **JP** or **LOOP** are programmed in such a way that a scan can never finish.
- that interrupt instructions are executed in succession.

11.2.3 All LEDs are OFF

<Procedure 1 >

Check the power supply wiring.

<Procedure 2>

Check if the power supplied to the FP0 control unit is in the range of the rating.

Be sure to check the fluctuation in the power supply.

<Procedure 3>

Disconnect the power supply wiring to the other devices if the power supplied to the FP0 control unit is shared with them.

If the LEDs on the FP0 control unit turn ON at this moment, the capacity of the power supply is not enough to control other devices as well.

Prepare another power supply for other devices or increase the capacity of the power supply.

11.2.4 Diagnosing Output Malfunction

Check of output condition (output indicator LEDs are ON)

<Procedure 1 >

Check the wiring of the loads.

<Procedure 2>

Check if the power is properly supplied to the loads.

If the power is properly supplied to the load, there is probably an abnormality in the load. Check the load again.

If the power is not supplied to the load, there is probably an abnormality in the FP0's output circuit. Please contact your dealer.

Check of output condition (output indicator LEDs are OFF)

<Procedure 1 >

Monitor the output condition using a programming tool.

If the output monitored is turned ON, there is probably a duplicated output error.

<Procedure 2>

Forcing ON the output using a programming tool.

If the output indicator LED is turned ON, go to input condition check.

If the output indicator LED remains OFF, there is probably an abnormality in the FP0's output circuit. Please contact your dealer.

Check of input condition (input indicator LEDs are OFF)

<Procedure 1 >

Check the wiring of the input devices.

↓

<Procedure 2>

Check that the power is properly supplied to the input terminals.

If the power is properly supplied to the input terminal, there is probably an abnormality in the FP0's input circuit. Please contact your dealer.

If the power is not properly supplied to the input terminal, there is probably an abnormality in the input device or input power supply. Check the input device and input power supply.

Check of input condition (input indicator LEDs are ON)

<Procedure >

Monitor the input condition using a programming tool.

If the input monitored is OFF, there is probably an abnormality in the FP0's input circuit. Please contact your dealer.

If the input monitored is ON, check the program again.
Also, check the leakage current at the input devices (e.g., two-wire type sensor) and check for the duplicated use of output or the program flow when a control instruction such as **MC** or **JP** is used.

Check the settings of the I/O allocation.

11.2.5 PROTECT ERROR is Displayed

When a password is set for the programmable controller

<Procedure >
Enter a password in the password setting menu in the FPWIN GR software and select enable.

1. In the menu select [Tool (T)] and then [Set PLC Password (P)].
2. The PLC password setting dialog box appears, shown below. Select the [Access] radio button, enter the password, and then click the [Settings] button.

11.2.6 Program Mode does not Change to RUN

<Condition>
A syntax error has occurred.

<Procedure >
Execute a total-check function to determine the location of the syntax error.

Refer to your software manual, for details about the total-check method.

Chapter 12

Specifications

12.1 Performance Specifications

Item			Relay output type		Transistor output type			S-LINK type
			C10RS/ C10RM/ C10CRS/ C10CRM	C14RS/ C14RM/ C14CRS/ C14CRM	C16T/ C16P/ C16CT/ C16CP	C32T/ C32P/ C32CT/ C32CP	T32C	SL1
Programming method/Control method			Relay symbol/Cyclic operation					
Controllable I/O points	**Basic unit**		Total: 10 Input: 6 Output: 4	Total: 14 Input: 8 Output: 6	Total: 16 Input: 8 Output: 8	Total: 32 Input: 16 Output: 16	Total: 32 Input: 16 Output: 16	Max. 128 Input: 64 Output: 64 at S-LINK block
	With expansion unit 1 When confi-gured with same output type as control unit		Max. 58	Max. 62	Max. 112	Max. 128	Max. 128	Max. 96 at expansion block
	With expansion unit 2 When relays and transistors are mixed		Max. 106	Max. 110	Max. 112	Max. 128	Max. 128	
Program memory	**Built-in memory**		Built in EEPROM (without battery)					
Program capacity			2,720 steps			5,000 steps	10,000 steps	5,000 steps
Numbers of instruction	**Basic**		83					
	High-level		145					
Operation speed			0.9μs/step (by basic instruction)					
I/O refresh and base time			With no expansion board: 0.3ms With expansion board(s): 0.3ms and (1 x number of expansion boards) ms					
Operation memory points	**Relay**	**Internal relay (R)**	1,008 points (R0 to R62F)				1,008 points (R0 to R62F) (* Note 1)	1,008 points (R0 to R62F)
		Special internal relay (R)	64 points (R9000 to R903F)					
		Timer/Counter (T/C)	144 points (initial setting is 100 timer points, T0 to T99 / 44 counter points, C100 to C143 (* Note 2)) Timer range: 1ms, 10ms, 100ms, 1s; selected by instruction					
	Memory area	**Data register (DT)**	1,660 words (DT0 to DT1659)			6,144 words (DT0 to DT6143)	16,384 words (DT0 to DT16383) (* Note 1)	6,144 words (DT0 to DT6143)
		Special data register (DT)	112 words (DT9000 to DT9111)				112 words (DT90000 to DT90111)	112 words (DT9000 to DT9111)
		Index register (IX, IY)	2 words					
Differential points (DF, DF/)			Unlimited of points					
Master control relay points (MCR)			32 points					
Number of labels (JP and LOOP)			64 labels				255 labels	64 labels

12.1 Performance Specifications

Item		Relay output type		Transistor output type			S-LINK type
		C10RS/ C10RM/ C10CRS/ C10CRM	C14RS/ C14RM/ C14CRS/ C14CRM	C16T/ C16P/ C16CT/ C16CP	C32T/ C32P/ C32CT/ C32CP	T32C	SL1
Number of step ladders		128 stages				704 stages (* Note 1)	128 stages
Number of subroutines		16 subroutines				100 sub-routines	16 sub-routines
Number of interrupt programs		7 programs (external 6 points, internal 1 point)					1 program (internal 1 point)
Self-diagnosis function		Such as watchdog timer, program syntax check					
Clock/calender function		Not available				Available (* Note 3)	Not available
Special functions	**Pulse catch input**	Total 6 points (X0 to X1: 50 µs; X2 to X5: 100 µs)					Not available
	Interrupt input						
	RS232C port (* Note 4) (Only units with an RS232C port)	Transmission speeds: 300/600/1200/2400/4800/9600/19200bit/s Transmission distance: 3m/9.84ft. Terminal block: 3-pin, made by phoenix Contact Co. (products number: MKDS1/3-3.5) Communication method: Half-duplex					
	Periodical interrupt	0.5ms to 30s interval					
	Constant scan	Available					
	Password	Available					
	High- speed counter function (* Note 5)	**Counter mode:** Addition/subtraction (one phase) (* Note 7) **- Input point number:** Four channels maximum **- Maximum counting speed:** 10kHz maximum for all 4 channels **- Input contacts used:** X0: count input (ch 0) X1: count input (ch 1) X2: reset input (*Note 8) X3: count input (ch 2) X4: count input (ch 3) X5: reset input (*Note 8) **- Minimum input pulse width:** X0, X1 ---------- 50 µs, <10kHz> X3, X4 ---------- 100 µs, <5kHz>					Not available
		Counter mode: Two-phase/individual/direction decision (two-phase) **- Input point number:** Two channels maximum **- Maximum counting speed:** 2kHz maximum for all 2 channels **- Input contacts used:** X0: count input (ch 0) X1: count input (ch 0) X2: reset input X3: count input (ch 2) X4: count input (ch 2) X5: reset input **- Minimum input pulse width:** X0, X1 ---------- 50 µs, <10kHz> X3, X4 ---------- 100 µs, <5kHz>					Not available

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="2">Relay output type</th><th colspan="3">Transistor output type</th><th>S-LINK type</th></tr>
<tr><th>C10RS/
C10RM/
C10CRS/
C10CRM</th><th>C14RS/
C14RM/
C14CRS/
C14CRM</th><th>C16T/
C16P/
C16CT/
C16CP</th><th>C32T/
C32P/
C32CT/
C32CP</th><th>T32C</th><th>SL1</th></tr>
<tr><td rowspan="4">Special functions</td><td rowspan="2">Pulse output function (* Note 6,10)</td><td>Output point number</td><td colspan="2">Not available</td><td colspan="3">Two independent points (Y0 and Y1)(no interpolation function)</td><td>Not available</td></tr>
<tr><td>Output frequency</td><td colspan="2">Not available</td><td colspan="3">40Hz to 10kHz (Y0/Y1: one-point output)
40Hz to 5kHz (Y0/Y1: two-point output)</td><td>Not available</td></tr>
<tr><td rowspan="2">PWM output function (* Note 6)</td><td>Output point number</td><td colspan="2">Not available</td><td colspan="3">Two points (Y0 and Y1)</td><td>Not available</td></tr>
<tr><td>Output frequency</td><td colspan="2">Not available</td><td colspan="2">Frequency: 0.15Hz to 38Hz,
(* Note 9)
Duty: 0.1% to 99.9%</td><td>Frequency: 0.15Hz to 1KHz
Duty: 0.1% to 99.9%</td><td>Not available</td></tr>
<tr><td rowspan="2">Memory backup (* Note 6) (* Note 12)</td><td colspan="2">Program and system register</td><td colspan="6">EEPROM</td></tr>
<tr><td colspan="2">Operation memory</td><td colspan="3">Areas which are held if the power supply fails are fixed, and are retained by the EEPROM.
- Number of points/words of the fixed hold areas in the various memories
Counters: 4 points
Internal relays: 32 points
Date registers: 8 words
(* Note 13)</td><td>Areas which are held if the power supply fails are fixed, and are retained by the EEPROM.
- Number of points/words of the fixed hold areas in the various memories
Counters: 16 points
Internal relays: 128 points
Date registers: 32 words
(* Note 14)</td><td>The operation memory is backed up using built-in chargeable (secondary) battery, so the hold type memory areas can be specified using the programming tools. (* Note 11)
- Memory areas which can be specified: Timers, Counters, Internal relays, Data registers</td><td>Areas which are held if the power supply fails are fixed, and are retained by the EEROM.
- Number of points/words of the fixed hold areas in the various memories
Counters: 16 points
Internal relays: 128 points
Date registers: 32 words
(* Note 14)</td></tr>
</table>

☛ next page

☞ Notes

1) Hold or non-hold type can be set using the system registers.

2) The proportion of timer points to counter points can be changed using a system register 5.

Notes

3) **Precision of calender timer:**
At 0_C/32_F, less than 139 second error per month.
At 25_C/77_F, less than 72 seconds error per month.
At 55_C/131_F, less than 169 seconds error per month.
This accuracy is considered to be the worst fluctuation coefficient value based on fluctuations in the normal voltage of 5V and the battery backup voltage of 3V. Also, F157 and F158 (time/date addition and subtraction instructions) cannot be used.

4) **When using the RS232C port for communication, we recommend using resend processing. The driver IC for the RS232C is in full conformance with EIA/TIA-232E and CCITT V.28 standards.**

5) **The combinations 1 phase × 2 channels and 2 phases × 1 channel are also possible for the high-speed counter.**

6) **The internal relay, data register, and timer/counter hold areas of the T32CT control unit (10 k step type) can be changed by the system registers. The number of points in the table is the value when the system registers are initial values.**

7) **The max. counting speed (10kHz) is the counting speed with a rated input voltage of 24V DC and an ambient temperature of 25°C. The counting speed (frequency) will decrease depending on the voltage and temperature.**

8) **If both reset inputs X0 and X1 are reset, X2 will be the reset input of X1. In the same way, for X3 and X4, X5 acts as the reset input of X4.**

9) **With a CPU of Ver. 1.2 or a subsequent version, the frequency will be 0.15Hz to 1kHz.**

10) **The maximum is 9.5kHz when the positioning control instruction (F168) is executed.**

11) **Precautions when using the battery backup function Secondary (chargeable) battery is used as backup battery in the FP0 T32C control unit. The battery is not charged before the unit is shipped, so please make sure that the built-in backup battery have been charged before using the unit.**

12) **The program, system registers and the hold type areas (internal relay, data register and counter) are backed up by the built in EEPROM.**

13) **The possible number of write times by the EEP-ROM write instruction is 100,000 or less.**

14) **The possible number of write times by the EEP-ROM write instruction is 10,000 or less.**

12.2 I/O Allocation Table

FP0 Control Units

The I/O allocation of the FP0 control unit is fixed.

Type of Control Unit		I/O number
C10 series	**Input: 6 points**	X0 to X5
	Output: 4 points	Y0 to Y3
C14 series	**Input: 8 points**	X0 to X7
	Output: 6 points	Y0 to Y5
C16 series	**Input: 8 points**	X0 to X7
	Output: 8 points	Y0 to Y7
C32/T32 series	**Input: 16 points**	X0 to XF
	Output: 16 points	Y0 to YF

S-LINK Control Units

The I/O allocation of the S-LINK control unit is fixed.

Unit	FP0 I/O	S-LINK address
Input: 64 points	X80 to X8F	0 to 15
	X90 to X9F	16 to 31
	X100 to X10F	32 to 47
	X110 to X11F	48 to 63
Output: 64 points	Y80 to Y8F	64 to 79
	Y90 to Y9F	80 to 95
	Y100 to Y10F	96 to 111
	Y110 to Y11F	112 to 127

FP0 Expansion Units

The I/O allocation of the FP0 expansion unit is determined by order of connection.

Type of Expansion Unit		I/O number		
		First expansion	Second expansion	Third expansion
E8X	**Input: 8 points**	X20 to X27	X40 to X47	X60 to X67
E8R	**Input: 4 points**	X20 to X23	X40 to X43	X60 to X63
	Output: 4 points	Y20 to Y23	Y40 to Y43	Y60 to Y63
E8YR/E8YT/E8YP	**Output: 8 points**	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16X	**Input: 16 points**	X20 to X2F	X40 to X4F	X60 to X6F
E16R/E16T/E16P	**Input: 8 points**	X20 to X27	X40 to X47	X60 to X67
	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16YT/E16YP	**Output: 16 points**	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
E32T/E32P	**Input: 16 points**	X20 to X2F	X40 to X4F	X60 to X6F
	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F

Analog I/O Unit

The I/O allocations of the analog I/O unit are determined by the position at which the unit is installed.

Type		First expansion	Second expansion	Third expansion
A21	**Input: CH0 16 points**	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Input: CH1 16 points	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
	Output: 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)

A/D Converter Unit and Thermocouple Unit

The data of each channel switches and then reads or writes by the user program which contains the conversion data switch flag.

Type		First expansion	Second expansion	Third expansion
A80, TC4, TC8	**Input: CH0, 2, 4, 6 16 points**	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Input: CH1, 3, 5, 7 16 points	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)

D/A Converter Unit

The data of each channel switches and then reads or writes by the user program which contains the conversion data switch flag.

Type		First expansion	Second expansion	Third expansion
A04V A04I	**Input: 16 points**	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Output: CH0, 2, 4, 6 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
	Output: CH1, 3, 5, 7 16 points	WY3 (Y30 to Y3F)	WY5 (Y50 to Y5F)	WY7 (Y70 to Y7F)

I/O Link Unit

The I/O allocation of the I/O link unit is determined by order of connection.

Type		First expansion	Second expansion	Third expansion
IOL	**Input: 32 points**	X20 to X3F	X40 to X5F	X60 to X7F
	output: 32 points	Y20 to Y3F	Y40 to Y5F	Y60 to Y7F

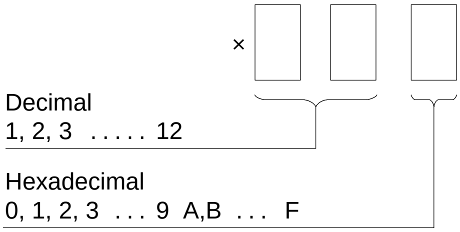
Note

Please verify with the manual for the FP0 CC-Link slave unit.

Expression of numbers for input/output relays

Since input/output relays X and Y are handled in units of 16 points, they are expressed as a combination of decimal and hexadecimal numbers as shown below.

Example: External input relay “X”



X 0, X 1 . . . . X F
X 10, X 11 . . . . X 1F
X 20, X 21 . . . . X 2F
to to to
X 70, X 71 . . . . X 7F

12.3 Relays, Memory Areas and Constants

Item		Numbering			Function
		C10/C14/ C16	**C32/SL1**	**T32**	
Relays	**External input relay** **X**	208 points (X0 to X12F)			Turns on or off based on external input.
	External output relay **Y**	208 points (Y0 to Y12F)			Externally outputs on or off state.
	Internal relay (* Note 1) **R**	1,008 points (R0 to R62F)			Relay which turns on or off only within program.
	Timer (* Note 1) **T**	144 points (T0 to T99/C100 to C143) (* Note 2)			If a **TM** instruction has timed out, the contact with the same number turns on.
	Counter (* Note 1) **C**				If a **CT** instruction has counted up, the contact with the same number turns on.
	Special internal relay **R**	64 points (R9000 to R903F)			Relay which turns on or off based on specific conditions and is used as a flag.
Memory Areas	**External input relay** **WX**	13 words (WX0 to WX12)			Code for specifying 16 external input points as one word (16 bits) of data.
	External output relay **WY**	13 words (WY0 to WY12)			Code for specifying 16 external output points as one word (16 bits) of data.
	Internal relay (* Note 1) **WR**	63 words (WR0 to WR62)			Code for specifying 16 internal relay points as one word (16 bits) of data.
	Data register (* Note 1) **DT**	1,660 words (DT0 to DT1659)	6,144 words (DT0 to DT6143)	16,384 words (DT0 to DT16383)	Data memory used in program. Data is handled in 16-bit units (one word).
	Timer/Counter set value area (* Note 1) **SV**	144 words (SV0 to SV143)			Data memory for storing a target value of a timer and an initial value of a counter. Stores by timer/counter number.
	Timer/Counter elapsed value area (* Note 1) **EV**	144 words (EV0 to EV143)			Data memory for storing the elapsed value during operation of a timer/counter. Stores by timer/counter number.
	Special data register **DT**	112 words (DT9000 to DT9111)		112 words (DT90000 to DT90111)	Data memory for storing specific data. Various settings and error codes are stored.
	Index register **IX IY**	2 words (IX, IY)			Register can be used as an address of memory area and constants modifier.
Constant	**Decimal constants** **K**	K-32768 to K32767 (for 16-bit operation)			
		K-2147483648 to K2147483647 (for 32-bit operation)			
	Hexadecimal constants **H**	H0 to HFFFF (for 16-bit operation)			
		H0 to HFFFFFFFF (for 32-bit operation)			

☛ next page

Notes

1) **There are two unit types, the hold type that saves the conditions that exist just before turning the power off or changing from the RUN mode to PROG. mode, and the non-hold type that resets them. These areas can be specified as hold type or non-hold type by setting system register. For the FP0 T32, the selection of hold type and non-hold type can be changed by the setting of system register. For details about the setting of system registers, refer to section 12.4. For the FP0 C10/C14/C16/C32/SL1, that area is fixed and allotted the numbers as shown below.**

Hold type and non-hold type areas

Item		C10/C14/C16	C32/SL1
Timer		Non-hold type: All points	
Counter	Non-hold type	From the set value to C139	From the set value to C127
	Hold type	4 points (elapsed values) (C140 to C143)	16 points (elapsed values) C128 to C143
Internal relay	Non-hold type	976 points (R0 to R60F) 61 words (WR0 to WR60)	880 points (R0 to R54F) 55 words (WR0 to WR54)
	Hold type	32 points (R610 to R62F) 2 words (WR61 to WR62)	128 points (R550 to R62F) 8 words (WR55 to WR62)
Data register	Non-hold type	1652 words (DT0 to DT1651)	6112 words (DT0 to DT6111)
	Hold type	8 words (DT1652 to DT1659)	32 words (DT6112 to DT6143)

2) **The points for the timer and counter can be changed by the setting of system register 5. The number given in the table are the numbers when system register 5 is at its default setting. For detailed about the system registers ☛ section 12.4**

12.4 Table of System Registers

12.4.1 System Registers

System register area

System registers are used to set values (parameters) which determine operation ranges and functions used. Set values based on the use and specifications of your program. There is no need to set system registers for functions which will not be used.

Types of system register

Allocation of timers and counters (System register 5)
The number of timers and counters is set by specifying the leading counter number.

Hold types and non-hold type settings (System register 6 to 8 and 14)
With the FP0, the areas held in the event of a power supply interruption are fixed, and the settings for system register 6 to 8, and 14, will be invalid.

Operation mode settings for errors (System register 20, 23 ,26 and 27)
Set the operation mode effective when errors such as doplicated use of output, operation, and I/O verification errors occur.

Time settings (System register 31 and 34)
Set the time-out error detection time and the constant scan time.

Input settings (System register 400 to 403)
When using the high-speed counter function, pulse catch function or interrupt function, set the operation mode and the input number to be used as a special input.

Tool port settings (System register 410, 411 and 414)
Set the tool port parameters when computer link will be used.

RS232C port settings (System register 412 to 418)
Only applicable for unit with RS232C port.

Modem connection setting (System register 411)
Set to ”Modem connection” when the tool port will be used for modem communication.

Checking and changing system register settings

System register values (parameters) can be set with K or H constants.

If you are going to use a value which is already set (the value which appears when read), there is no need to write it again.

Using programming tool software

Procedure:

1. **Set the mode of the FP0 control unit to PROG.**
2. **Select the "SYSTEM REGISTER" in "PLC CONFIGURATION" option from the menu.**
3. **Select the function to be set in the "SYSTEM REGISTER" in "PLC CONFIGURATION" screen. The value set in the selected system register will appear.**
4. **To change a set value, write the new value as indicated in the system register table.**
5. **It does "OK", and resistration is done.**

Using FP programmer II

Procedure:

1. **Set the mode of the FP0 control unit to PROG.**
2. **Press the keys on the FP programmer II, as shown below.**

   ACLR | (-) OP | 5 | 0 | ENT

3. **Specify the register number (e.g. No.20) for the parameter to be set and read the parameter.**
   The value set in the selected register will be displayed.

   2 | 0 | READ ▼

4. **To change the set value, press the <CLR (clear)> key and write the new value as indicated in the system register table.**

Precautions when setting system registers

System register settings are effective from the time they are set.
However, input, tool port, RS232C port, and modem connection settings become effective when the mode is changed from PROG. to RUN. With regard to the modem connection setting, when the power is turned off and on or when the mode is changed from PROG. to RUN, the controller sends a command to the modem which enables it for reception.

When the initialized operation is performed, all set system resister values (parameters) will be initialized.

12.4.2 Content of System Register Settings

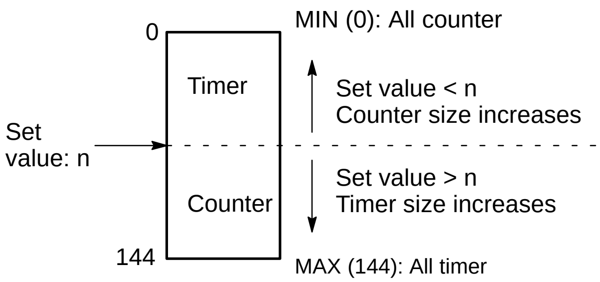
Setting the timers and counters (System register 5)

By indicating the counter start number, the timer and counter are split into two areas. The timer and counter together total 144 points, and the default value for the split is 100. Thus the point allotment is as shown in the table below.

Timer	100 points (No. 0 to No. 99)
Counter	44 points (No. 100 to No. 143)

Setting example

To increase the number of timers to 120, change the value of system register 5 to K120.



For FP0 T32, set the system registers 5 and 6 to the same value. This sets the timer to a non-hold type and counter to a hold type.

By setting system register 5 to “0”, the whole area becomes the counter. Also, by setting it to the value “144”, the whole area becomes the timer.

Hold types and non-hold type settings (System registers 6 to 8 and 14)

With the FP0 C10/C14/C16/C32/SL1, the areas held in the event of a power supply interruption are fixed at the areas shown in the table below, and the settings for system registers 6 to 8 and 14, will be invalid.

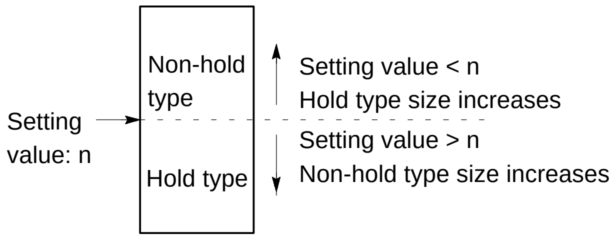
C10/C14/C16

Timer	Non-hold type: All points
Counter	Non-hold type: From the set value to C139
	Hold type: 4 points (elapsed values) C140 to C143
Internal relay	Non-hold type: 976 points (R0 to R60F) 61 words (WR0 to WR60)
	Hold type: 32 points (R610 to R62F) 2 words (WR61 to WR62)
Data register	Non-hold type: 1652 words (DT0 to DT1651)
	Hold type: 8 words (DT1652 to DT1659)

C32/SL1

Timer	Non-hold type: All points
Counter	Non-hold type: From the set value to C127
	Hold type: 16 points (elapsed values) C128 to C143
Internal relay	Non-hold type: 880 points (R0 to R54F) 55 words (WR0 to WR54)
	Hold type: 128 points (R550 to R62F) 8 words (WR55 to WR62)
Data register	Non-hold type: 6112 words (DT0 to DT6111)
	Hold type: 32 words (DT6112 to DT6143)

With the FP0 T32, set each relay and register to a hold type or non-hold type.



For normal situations, set the system registers 5 and 6 to the same value. This sets the timer to a non-hold type and counter to a hold type.

By setting this value to "0", the whole area becomes hold type. Also, by setting it to the value 1 higher than the last number, the whole area becomes non-hold type.

Default value

Area \ Type		FP0 T32
Timer		All non-hold type
Counter		All hold type
Internal relay	**Non-hold type**	Non-hold type: 10 words (WR0 to WR9)
	Hold type	Hold type: 53 words (WR10 to WR62)
Data register		All hold type

12.4.3 Table of System Registers

C10, C14, C16, C32, T32 and SL1 in the table respectively indicate 10-point, 14-point, 16-point, 32-point type and S-LINK type FP0 control units.

Item	Address	Name	Default value	Description
Allocation of user memory	**0**	**Sequence program area capacity**	—	The set values are fixed and cannot be changed. The stored values vary depending on the type. K3: 3K words (FP0 C10, C14, C16) K5: 5K words (FP0 C32, SL1) K10: 10K words (FP0 T32)
	1 to 3	**Not used**	—	—
Hold/ Non-hold	**5**	**Timer and counter division (setting of starting counter number)**	K100	K0 to K144
	6 to 8	**Not used (Available type: C10, C14, C16, C32, SL1)**	—	With the FP0 C10/C14/C16/C32/SL1, values set with the programming tool become invalid.
	6	**Hold type area starting number setting for timer and counter (Available type: T32)**	K100	K0 to K144 Set the system registers 5 and 6 to the same value.
	7	**Hold type area starting number setting for internal relays (in word units) (Available type: T32)**	K10	K0 to K63
	8	**Hold type area starting number setting for data registers (Available type: T32)**	K0	K0 to K16384
	9 to 13	**Not used**	—	—
	14	**Not used (Available type: C10, C14, C16, C32, SL1)**	—	With the FP0 C10/C14/C16/C32/SL1, values set with the programming tool become invalid.
		Hold or non-hold setting for step ladder process (Available type: T32)	K1	K0: Hold K1: Non-hold
	15	**Not used**	—	—
Action on error	**20**	**Disable or enable setting for duplicated output**	K0	K0: Disable (will be syntax error) K1: Enable (will not be syntax error)
	21, 22	**Not used**	—	—
	23	**Operation setting when an I/O verification error occurs**	K0	K0: Stop K1: Continuation
	24, 25	**Not used**	—	—
	26	**Operation setting when an operation error occurs**	K0	K0: Stop K1: Continuation
	27	**Operation settings when communication error occurs in the remote I/O (S-LINK) system**	K1	K0: Stop K1: Continuation

<table>
<tr><th>Item</th><th>Address</th><th>Name</th><th>Default value</th><th>Description</th></tr>
<tr><td rowspan="2">Action on error</td><td>28, 29</td><td>Not used</td><td>——</td><td>——</td></tr>
<tr><td>4</td><td>Not used</td><td>——</td><td>With the FP0, values set with the programming tool become invalid.</td></tr>
<tr><td rowspan="4">Time setting</td><td>30</td><td>Unused</td><td>——</td><td>——</td></tr>
<tr><td>31</td><td>Wait time setting for multi-frame communication</td><td>K2600 (6500 ms)</td><td>K4 to K32760: 10 ms to 81900 ms
Used of default setting (K2600/ 6500 ms) is recommended.
set value × 2.5 ms = Wait time setting for multi-frame communication (ms)
In programming tool software, enter the time (a number divisible by 2.5).
In FP Programmer II, enter the set value (equal to the time divided by 2.5).</td></tr>
<tr><td>32, 33</td><td>Unused</td><td>——</td><td>With the FP0, values set with the programming tool become invalid.</td></tr>
<tr><td>34</td><td>Constant value settings for scan time</td><td>K0</td><td>K1 to K64 (2.5 ms to 160 ms): Scans once each specified time interval.
K0: Normal scan
set value × 2.5 ms = Constant value setting for scan time (ms)
In programming tool software, enter the time (a number divisible by 2.5).
In FP Programmer II, enter the set value (equal to the time divided by 2.5).</td></tr>
</table>

Item	Ad-dress	Name		Default value	Description	
Input setting	**400**	**High-speed counter mode settings (X0 to x2)**	**Setting by programming tool software**	H0	CH0	0: Do not set input X0 as high-speed counter. 1: 2-phase input (X0, X1) 2: 2-phase input (X0, X1), Reset input (X2) 3: Incremental input (X0) 4: Incremental input (X0), Reset input (X2) 5: Decremental input (X0) 6: Decremental input (X0), Reset input (X2) 7: Individual input (X0, X1) 8: Individual input (X0, X1), Reset input (X2) 9: Direction decision (X0, X1) 10: Direction decision (X0, X1), Reset input (X2)
					CH1	0: Do not set input X1 as high-speed counter. 3: Incremental input (X1) 4: Incremental input (X1), Reset input (X2) 5: Decremental input (X1) 6: Decremental input (X1), Reset input (X2)

Notes

- **If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH1 is invalid.**
- **If reset input settings overlap, the setting of CH1 takes precedence.**
- **If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] ' [Pulse catch] ' [Interrupt input].**

Item	Ad-dress	Name		Default value	Description	
Input setting	**400**	**High-speed counter mode settings (X0 to x2)**	**Setting by FP programmer II**	H0	CH0/ CH1	H 0 ☐ 0 ☐ 0: Do not use high-speed counter. 1: 2-phase input (X0, X1) 2: 2-phase input (X0, X1), Reset input (X2) 3: Incremental input (X0) 4: Incremental input (X0), Reset input (X2) 5: Decremental input (X0) 6: Decremental input (X0), Reset input (X2) 7: Individual input (X0, X1) 8: Individual input (X0, X1), Reset input (X2) 9: Direction dicision (X0, X1) A: Direction dicision (X0, X1), Reset input (X2) 0: Do not use high-speed counter. 3: Incremental input (X1) 4: Incremental input (X1), Reset input (X2) 5: Decremental input (X1) 6: Decremental input (X1), Reset input (X2)

Notes

- **If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH1 is invalid.**
- **If reset input settings overlap, the setting of CH1 takes precedence.**
- **If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] ' [Pulse catch] ' [Interrupt input].**

Item	Ad-dress	Name		Default value	Description	
Input setting	**401**	**High-speed counter mode settings (X3 to X5)**	**Setting by programming tool software**	H0	CH2	0: Do not set input X3 as high-speed counter. 1: 2-phase input (X3, X4) 2: 2-phase input (X3, X4), Reset input (X5) 3: Incremental input (X3) 4: Incremental input (X3), Reset input (X5) 5: Decremental input (X3) 6: Decremental input (X3), Reset input (X5) 7: Individual input (X3, X4) 8: Individual input (X3, X4), Reset input (X5) 9: Direction decision (X3, X4) 10: Direction decision (X3, X4), Reset input (X5)
					CH3	0: Do not set input X4 as high-speed counter. 3: Incremental input (X4) 4: Incremental input (X4), Reset input (X5) 5: Decremental input (X4) 6: Decremental input (X4), Reset input (X5)

Notes

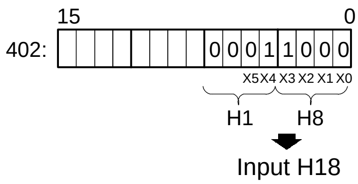
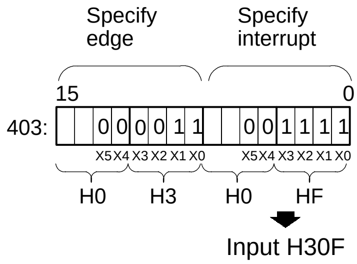
- **If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH3 is invalid.**
- **If reset input settings overlap, the setting of CH3 takes precedence.**
- **If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] ' [Pulse catch] ' [Interrupt input].**

Item	Address	Name		Default value	Description	
Input setting	**401**	**High-speed counter mode settings (X3 to X5)**	**Setting by FP programmer II**	H0	CH2/ CH3	H 0 ⌷ 0 ⌷ CH3 (second digit): 0: Do not use high-speed counter. 3: Incremental input (X4) 4: Incremental input (X4), Reset input (X5) 5: Decremental input (X4) 6: Decremental input (X4), Reset input (X5) CH2 (fourth digit): 0: Do not use high-speed counter. 1: 2-phase input (X3, X4) 2: 2-phase input (X3, X4), Reset input (X5) 3: Incremental input (X3) 4: Incremental input (X3), Reset input (X5) 5: Decremental input (X3) 6: Decremental input (X3), Reset input (X5) 7: Individual input (X3, X4) 8: Individual input (X3, X4), Reset input (X5) 9: Direction dicision (X3, X4) A: Direction dicision (X3, X4), Reset input (X5)

Notes

- **If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH3 is invalid.**
- **If reset input settings overlap, the setting of CH3 takes precedence.**
- **If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] ' [Pulse catch] ' [Interrupt input].**

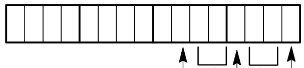
12.4 Table of System Registers

Item	Address	Name	Default value	Description
Input setting	**402**	**Pulse catch input function settings**	H0	X5 X4 X3 X2 X1 X0 0 0 0 0 0 0 0: Standard input 1: Pulse catch input In FP Programmer II, enter the above settings in hexadecimal. When X3 and X4 are set to pulse catch input  With the FP0, settings X6 and X7 are invalid.
	403	**Interrupt input settings**	H0	Using programming tool software X5 X4 X3 X2 X1 X0 Specify the input contacts used as interrupt inputs in the upper byte. (0: Standard input/1: Interrupt input) X5 X4 X3 X2 X1 X0 Specify the effective interrupt edge in the lower byte. (When 0: on/When 1: off) Using FP programmer II When setting inputs X0, X1, X2, and X3 as interrupts, and X0 and X1 are set as interrupt inputs when going from on to off. 
	404 to 407	**Unused**	——	With the FP0, values set with the programming tool become invalid.

Notes

- **With the TOOL software, “0” or “1” is set for each bit on the screen in the setting for system register 403.**
- **If system register 400 to 403 are set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] ' [Pulse catch] ' [Interrupt input].**
  When the high-speed counter is being used in the incremental input mode, even if input X0 is specified as an interrupt input and as pulse catch input, those settings are invalid, and input X0 functions as counter input for the high-speed counter.
  No. 400: H1 a **This setting will be valid.**
  No. 402: H1
  No. 403: H1

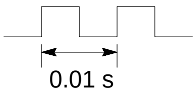
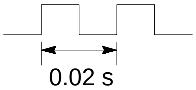
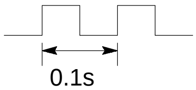
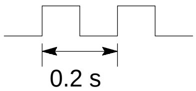
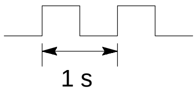
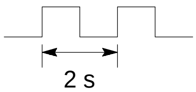
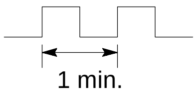
Item	Address	Name		Default value	Description
Tool port setting	**410**	**Unit number setting for tool port (when connecting C-NET)**		K1	K1 to K32 (Unit No. 1 to 32)
	411	**Communication format setting for tool port** **Setting item** S **Default setting value** S **Modem communication: Disabled** S **Data length (character bits): 8 bits**		H0	Using programming tool software Select items from the menu. Using FP programmer II Specify the setting contents using H constants. 15 6 0 Modem communication 0: Disabled 1: Enabled Data length (character bits) 0: 8 bits 1: 7 bits When connecting a modem, set the unit number to 1 with system resister 410.
	414	**Baud rate setting for tool port**	**Setting by programming tool software**	H0	0: 9600 bit/s 1: 19200 bit/s
Tool port/ RS232C port setting	**414**	**Baud rate setting for tool port and RS232C port**	**Setting by FP programmer II**	H1	H 0 0 Tool port H0: 9600 bit/s H1: 19200 bit/s (If anything other than H0 or H1 is set for the tool port baud rate, the baud rate will be 9600 bit/s.) RS232C port H0: 19200 bit/s H1: 9600 bit/s H2: 4800 bit/s H3: 2400 bit/s H4: 1200 bit/s H5: 600 bit/s H6: 300 bit/s If 19,200 bit/s is set for both the tool port and RS232C port ' H100 should be written.

Item	Address	Name		Default value	Description
RS232C port setting	**412**	**Communication method setting for RS232C port**		K0	Using programming tool software Select items from the menu. Using FP programmer II K0: RS232C port is not used. K1: Computer link mode (when connecting C-NET) K2: Serial data communication mode (general port)
	413	**Communication format setting for RS232C port** **Setting item/Default setting value** **- Start code: None** **- Terminal code: CR** **- Stop bit: 1 bit** **- Parity check: With odd** **- Data length: 8 bits**		H3	Using programming tool software Select items from the menu. Using FP programmer II Specify the setting contents using H constants.  15 6 0 Start code 0: No STX 1: STX Terminal code 00: CR 01: CR+LF 10: None 11: ETX Stop bit 0: 1 bit 1: 2 bits Parity check 00: None 01: With odd 11: With even Data length 0: 7 bits 1: 8 bits
	414	**Baud rate setting for RS232C port**	**Setting by programming tool software**	H1	0: 19200 bit/s 1: 9600 bit/s 2: 4800 bit/s 3: 2400 bit/s 4: 1200 bit/s 5: 600 bit/s 6: 300 bit/s
	415	**Unit number setting for RS232C port (when connecting C-NET)**		K1	K1 to K32 (unit No. 1 to 32)
	416	**Modem compatibility setting for RS232C port**		H0	Using programming tool software Select items from the menu. Using FP programmer II H0: Modem disabled H8000: Modem enabled
	417	**Starting address setting for reception buffer**		K0	C10C/C14C/C16C: K0 to K1659 C32C/SL1: K0 to K6143 T32C: K0 to K16383
	418	**Capacity setting for reception buffer**	**C10C/ C14C/ C16C**	K1660	K0 to K1660
			C32C/SL1	K6144	K0 to K6144
			T32C	K16384	K0 to K16384

12.5 Table of Special Internal Relays

The special internal relays turn on and off under special conditions. The on and off states are not output externally. Writing is not possible with a programming tool or an instruction.

Address	Name	Description
R9000	**Self-diagnostic error flag**	Turns on when a self-diagnostic error occurs. The self-diagnostic error code is stored in DT9000.
R9001 to R9003	————	Not used
R9004	**I/O verification error flag**	Turns on when an I/O verification error occurs. The position number of the I/O where the verification error was occured is stored in DT9010.
R9005, R9006	————	Not used
R9007	**Operation error flag (hold)**	Turns on and keeps the on state when an operation error occurs. The address where the error occurred is stored in DT9017 (indicates the first operation error which occurred).
R9008	**Operation error flag (non-hold)**	Turns on for an instant when an operation error occurs. The address where the operation error occurred is stored in DT9018. The contents change each time a new error occurs.
R9009	**Carry flag**	Turns on for an instant, - when an overflow or underflow occurs. - when “1” is set by one of the shift instructions.
R900A	**> flag**	Turns on for an instant when the compared results become larger in the “**F60 (CMP)** to **F63 (DWIN)** comparison instructions.”
R900B	**= flag**	Turns on for an instant, - when the compared results are equal in the comparison instructions (**F60** to **F63**). - when the calculated results become 0 in the arithmetic instructions.
R900C	**< flag**	Turns on for an instant when the compared results become smaller in the “**F60 (CMP)** to **F63 (DWIN)** comparison instructions.”
R900D	**Auxiliary timer contact**	Turns on when the set time elapses (set value reaches 0) in the timing operation of the **F137 (STMR)/F183 (DSTM)** auxiliary timer instruction. It turns off when the trigger for auxiliary timer instruction turns off.
R900E	**Tool port error flag**	This turns on when an error occurs during communication with a programming tool.
R900F	**Constant scan error flag**	Turns on when scan time exceeds the time specified in system register 34 during constant scan execution.
R9010	**Always on relay**	Always on.
R9011	**Always off relay**	Always off.
R9012	**Scan pulse relay**	Turns on and off alternately at each scan.

Address	Name	Description
R9013	**Initial on pulse relay**	Turns on only at the first scan in the operation. Turns off from the second scan and maintains the off state.
R9014	**Initial off pulse relay**	Turns off only at the first scan in the operation. Turns on from the second scan and maintains the on state.
R9015	**Step ladder initial on pulse relay**	Turns on for an instant only in the first scan of the process the moment step ladder process is opened.
R9016, R9017	————	Not used
R9018	**0.01 s clock pulse relay**	Repeats on/off operations in 0.01 s cycles. 
R9019	**0.02 s clock pulse relay**	Repeats on/off operations in 0.02 s cycles. 
R901A	**0.1 s clock pulse relay**	Repeats on/off operations in 0.1 s cycles. 
R901B	**0.2 s clock pulse relay**	Repeats on/off operations in 0.2 s. cycles 
R901C	**1 s clock pulse relay**	Repeats on/off operations in 1 s cycles. 
R901D	**2 s clock pulse relay**	Repeats on/off operations in 2 s cycles. 
R901E	**1 min clock pulse relay**	Repeats on/off operations in 1 min cycles. 
R901F	————	Not used
R9020	**RUN mode flag**	Turns off while the mode selector is set to PROG. Turns on while the mode selector is set to RUN.
R9021 to R9025	————	Not used
R9026 (* Note)	**Message flag**	Turns on while the **F149 (MSG)** instruction is executed.
R9027 (* Note)	**Remote mode flag**	Turns on while the mode selector is set to REMOTE.
R9028	————	Not used

Note

Used by the system.

12.5 Table of Special Internal Relays

Address	Name	Description
R9029 (* Note)	**Forcing flag**	Turns on during forced on/off operation for I/O relay and timer/counter contacts.
R902A (* Note)	**External interrupt enable flag**	Turns on while the external interrupt trigger is enabled by the **ICTL** instruction.
R902B (* Note)	**Interrupt error flag**	Turns on when an interrupt error occurs.
R902C to R902F	———	Not used
R9030, R9031	———	Not used
R9032	**RS232C port mode flag**	When “General-use port” is selected, ”K2” goes on.
R9033	**Printout instruction flag**	Turns on while a **F147 (PR)** instruction is executed. Turns off when a **F147 (PR)** instruction is not executed.
R9034	**Rewrite during RUN flag**	This is a special internal relay that goes on for only the first scan following the completion of rewriting in the RUN mode. (CPU Ver. 2.1 or later available)
R9035	**S-LINK I/O communication error flag**	Turns on when the S-LINK error (ERR 1, 3 or 4) occurs using S-LINK system.
R9036	**S-LINK communication status flag**	Turns on when communication is taking place with an S-LINK input/output unit.
R9037	**RS232C communication error flag**	Turns on when the serial data communication error occurs.
R9038	**RS232C reception completed flag**	Turns on when a terminator is received during the serial data communicating.
R9039	**RS232C transmission completed flag**	Turns on while data is not send during the serial data communicating. Turns off while data is being sent during the serial data communicating.
R903A	**High-speed counter control flag for ch0**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903B	**High-speed counter control flag for ch1**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903C	**High-speed counter control flag for ch2**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903D	**High-speed counter control flag for ch3**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903E, R903F	———	Not used

☞ **Note**

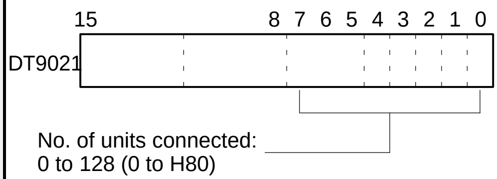
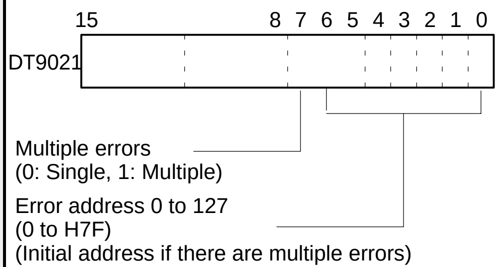
Used by the system.

12.6 Table of Special Data Registers

The special data registers are one word (16-bit) memory areas which store specific information. With the exception of registers for which “Writing is possible” is indicated in the “Description” column, these registers cannot be written to.

Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
DT90000	**DT9000**	**Self-diagnostic error code**	The self-diagnostic error code is stored here when a self-diagnostic error occurs. Monitor the error code using decimal display.
DT90010	**DT9010**	**I/O verify error unit**	The position of the I/O for which an error occurred is stored in bits 0 to 3.
DT90014	**DT9014**	**Auxiliary register for operation**	One shift-out hexadecimal digit is stored in bit positions 0 to 3 when **F105 (BSR)** or **F106 (BSL)** instruction is executed.
DT90015	**DT9015**	**Auxiliary register for operation**	The divided remainder (16-bit) is stored in DT9015/DT90015 when **F32 (%)** or **F52 (B%)** instruction is executed.
DT90016	**DT9016**		The divided remainder (32-bit) is stored DT9015 and DT9016/DT90015 and DT90016 when **F33 (D%)** or **F53 (DB%)** instruction is executed.
DT90017	**DT9017**	**Operation error address (hold)**	After commencing operation, the address where the first operation error occurred is stored. Monitor the address using decimal display.
DT90018	**DT9018**	**Operation error address (non-hold)**	The address where a operation error occurred is stored. Each time an error occurs, the new address overwrites the previous address. At the beginning of scan, the address is 0. Monitor the address using decimal display.
DT90019	**DT9019**	**2.5ms ring counter**	The data stored here is increased by one every 2.5ms. (H0 to HFFFF) Difference between the values of the two points (absolute value) × 2.5ms = Elapsed time between the two points.

Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
———	**DT9020 (Available type: SL1)**	**S-LINK status flag / error flag**	15 5 4 3 2 1 0 DT9020 ← Not used → S-LINK communication status (1: Communication in progress) ERR4 (1: Disconnected wire, or S-LINK input/output unit error) ERR3 (1: Problem with voltage level between D and G) Not used ERR1 (1: Short-circuit between D and G) Notes S ERR1 and ERR3 occur even if the power supply on the S-LINK side is interrupted, but are canceled when the power supply is turned on again. S ERR4 is held. To cancel it, repair the disconnected wire in the S-LINK system, or whatever is causing the problem, and then either turn the power to the FP0 on again, press the SET switch to reset it, or turn the power supply on again on the S-LINK unit side.

Address		Name	Description
FP0 T32	FP0 C10, C14, C16, C32, SL1		
———	**DT9021 (Available type: SL1)**	**No. of units connected to S-LINK / error address**	(When normal)  Note • When the SET switch is pressed, the number of input/output units connected to the S-LINK system is set. (If the same address has been specified for multiple units, the units are counted as a single unit. This is invalid, however, if an ERR4 error is in progress.) (If ERR4 occurs) 
DT90022	**DT9022**	**Scan time (current value) (* Note)**	The current scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K50 indicates 5ms.

Note

Scan time display is only possible in RUN mode, and shows the operation cycle time. The maximum and minimum values are cleared when each the mode is switched between RUN mode and PROG. mode.

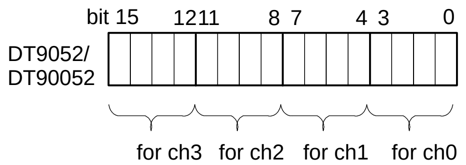
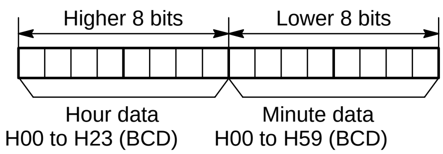
Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
DT90023	**DT9023**	**Scan time (minimum value) (* Note 1)**	The minimum scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K50 indicates 5ms.
DT90024	**DT9024**	**Scan time (maximum value) (* Note 1)**	The maximum scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K125 indicates 12.5ms.
DT90025 (* Note 2)	**DT9025 (* Note 2)**	**Mask condition monitoring register for interrupts (INT 0 to 5)**	The mask conditions of interrupts using **ICTL** instruction can be monitored here. Monitor using binary display. 15 11 7 3 0 (Bit No.) 23 19 16 (INT No.) 0: interrupt disabled (masked) 1: interrupt enabled (unmasked)
DT90026	**DT9026**	————	Not used
DT90027 (* Note 2)	**DT9027 (* Note 2)**	**Periodical interrupt interval (INT 24)**	The value set by **ICTL** instruction is stored. - K0: periodical interrupt is not used - K1 to K3000: 10ms to 30s
DT90028	**DT9028**	————	Not used
DT90029	**DT9029**	————	Not used
DT90030 (* Note 2)	**DT9030 (* Note 2)**	**Message 0**	The contents of the specified message are stored in these special data registers when **F149 (MSG)** instruction is executed.
DT90031 (* Note 2)	**DT9031 (* Note 2)**	**Message 1**	
DT90032 (* Note 2)	**DT9032 (* Note 2)**	**Message 2**	
DT90033 (* Note 2)	**DT9033 (* Note 2)**	**Message 3**	
DT90034 (* Note 2)	**DT9034 (* Note 2)**	**Message 4**	
DT90035 (* Note 2)	**DT9035 (* Note 2)**	**Message 5**	
DT90036	**DT9036**	————	Not used
DT90037	**DT9037**	**Work 1 for F96 (SRC) instruction**	The number of data that match the searched data is stored here when **F96 (SRC)** instruction is executed.

Notes

1) Scan time display is only possible in RUN mode, and shows the operation cycle time. The maximum and minimum values are cleared when each the mode is switched between RUN mode and PROG. mode.

2) Used by the system.

Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
DT90038	**DT9038**	**Work 2 for F96 (SRC) instruction**	The position of the first matching data, counting from the starting 16-bit area, is stored here when an **F96 (SRC)** instruction is executed.
DT90039 to DT90043	**DT9039 to DT9043**	————	Not used
DT90044	**DT9044**	**High-speed counter elapsed value for ch0**	The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the **ED** instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9044 and DT9045/DT90044 and DT90045. The value can be written by executing **F1 (DMV)** instruction.
DT90045	**DT9045**		
DT90046	**DT9046**	**High-speed counter target value for ch0**	The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction **F166** to **F170** is executed. These preset values can only be read, and cannot be written.
DT90047	**DT9047**		
DT90048	**DT9048**	**High-speed counter elapsed value area for ch1**	The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the **ED** instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9048 and DT9049/DT90048 and DT90049. The value can be written by executing **F1 (DMV)** instruction.
DT90049	**DT9049**		
DT90050	**DT9050**	**High-speed counter target value area for ch1**	The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction **F166** to **F170** is executed. These preset values can only be read, and cannot be written.
DT90051	**DT9051**		

Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
DT90052	**DT9052**	**High-speed counter control flag**	A value can be written with **F0 (MV)** instruction to reset the high-speed counter, disable counting, stop high-speed counter instruction **(F168)**, and clear the high-speed counter. Control code setting Control code = j j j j (Binary) Software reset 0: Yes / 1: No Count 0: Enable / 1: Disable Hardware reset 0: Enable / 1: Disable High-speed counter clear 0: Continue / 1: Clear Software is not reset: H0 (0000) Perform software reset: H1 (0001) Disable count: H2 (0010) Disable hardware reset: H4 (0100) Stop pulse output (clear instruction): H8 (1000) Perform software reset and stop pulse output: H9 (1001) The 16 bits of DT9052/DT90052 are allocated in groups of four to high-speed channels 0 to 3 as shown below.  A hardware reset disable is only effective when using the reset inputs (X2 and X5). In all other cases it is ignored. When using pulse output, a hardware reset input is equivalent to an home point proximate input.
DT90053	————	**Clock/calendar monitor (hour/minute)**	Hour and minute data of the clock/calendar are stored here. This data is read-only data; it cannot be overwritten. 

<table>
<tr><th colspan="2">Address</th><th rowspan="2">Name</th><th rowspan="2">Description</th></tr>
<tr><th>FP0 T32</th><th>FP0 C10, C14, C16, C32, SL1</th></tr>
<tr><td>DT90054</td><td>———</td><td>Clock/calendar monitor and setting (minute/second)</td><td rowspan="4">The year, month, day, hour, minute, second, and day-of-the-week data for the calendar timer is stored. The built-in calendar timer will operate correctly through the year 2099 and supports leap years. The calendar timer can be set (the time set) by writing a value using a programming tool software or a program that uses the F0 (MV) instruction.
<table>
<tr><th></th><th>Higher 8 bits</th><th>Lower 8 bits</th></tr>
<tr><td>DT90054</td><td>Minute data
H00 to H59 (BCD)</td><td>Second data
H00 to H59 (BCD)</td></tr>
<tr><td>DT90055</td><td>Day data
H01 to H31 (BCD)</td><td>Hour data
H00 to H23 (BCD)</td></tr>
<tr><td>DT90056</td><td>Year data
H00 to H99 (BCD)</td><td>Month data
H01 to H12 (BCD)</td></tr>
<tr><td>DT90057</td><td>———</td><td>Day-of-the-week data
H00 to H06 (BCD)</td></tr>
</table></td></tr>
<tr><td>DT90055</td><td>———</td><td>Clock/calendar monitor and setting (day/hour)</td></tr>
<tr><td>DT90056</td><td>———</td><td>Clock/calendar monitor and setting (year/month)</td></tr>
<tr><td>DT90057</td><td>———</td><td>Clock/calendar monitor and setting (day-of-the-week)</td></tr>
</table>

<table>
<tr><th colspan="2">Address</th><th rowspan="2">Name</th><th rowspan="2">Description</th></tr>
<tr><th>FP0 T32</th><th>FP0 C10, C14, C16, C32, SL1</th></tr>
<tr><td>DT90058</td><td>——</td><td>Clock/calendar time setting and 30 seconds correction</td><td>
The clock/calendar is adjusted as follows.
When setting the clock/calendar by program
By setting the the highest bit of DT90058 to 1, the time becomes that written to DT90054 to DT90057 by F0 (MV) instruction. After the time is set, DT90058 is cleared to 0. (Cannot be performed with any instruction other than F0 (MV) instruction.)
Example:
Set the time to 12:00:00 on the 5th day when the X0 turns on.
<pre>
   X0
──┤ ├────(DF)──────────> 1 ──
── 1 >──[F0 MV, H   0, DT90054] . . Inputs 0 minutes and 0 seconds
        [F0 MV, H   512, DT90055] . . Inputs 12th hour 5th day
        [F0 MV, H8000, DT90058]   . . Sets the time
</pre>
If you changed the values of DT90054 to DT90057 with the data monitor functions of programming tool software, the time will be set when the new values are written. Therefore, it is unnecessary to write to DT90058.
When the correcting times less than 30 seconds
By setting the lowest bit of DT90058 to 1, the value will be moved up or down and become exactly 0 seconds. After the correction is completed, DT90058 is cleared to 0.
Example:
Correct to 0 seconds with X0 turns on
<pre>
   X0
──┤ ├────(DF)──────────> 1 ──
── 1 >──[F0 MV, H   1, DT90058]   Correct to 0 second.
</pre>
At the time of correction, if between 0 and 29 seconds, it will be moved down, and if the between 30 and 59 seconds, it will be moved up. In the example above, if the time was 5 minutes 29 seconds, it will become 5 minutes 0 second; and, if the time was 5 minutes 35 seconds, it will become 6 minutes 0 second.
</td></tr>
</table>

☞ Note

After discharging the battery (including when the power is turned on for the first time), the values of DT90053 to DT90058 change at random. Once the time and date have been set, these values will function normally.

Address FP0 T32	Address FP0 C10, C14, C16, C32, SL1	Name		Description
DT90059	DT9059	**Serial communication error code**		DT9059/ DT90059: bit 15, 12 11, 8 7, 4 3, 0 bits 8–15: Error flag of RS232C port; bits 0–7: Error flag of tool port § Tool port: bit 0 = 1: Over run error bit 1 = 1: Framing error bit 2 = 1: Parity error § RS232C port: bit 8 = 1: Over run error bit 9 = 1: Framing error bit 10 = 1: Parity error
DT90060	DT9060	**Step ladder process**	**Process number: 0 to 15**	Indicates the startup condition of the step ladder process. When the proccess starts up, the bit corresponding to the process number turns on "1". Monitor using binary display. DT9060/ DT90060: 15 11 7 3 0 (Bit No.) 15 11 7 3 0 (Process No.) 0: not-executing 1: executing A programming tool software can be used to write data.
DT90061	DT9061		**Process number: 16 to 31**	
DT90062	DT9062		**Process number: 32 to 47**	
DT90063	DT9063		**Process number: 48 to 63**	
DT90064	DT9064		**Process number: 64 to 79**	
DT90065	DT9065		**Process number: 80 to 95**	
DT90066	DT9066		**Process number: 96 to 111**	
DT90067	DT9067		**Process number: 112 to 127**	
DT90104	DT9104	**High-speed counter elapsed value area for ch2**		The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the **ED** instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9104 and DT9105/DT90104 and DT90105. The value can be written by executing a **DMV (F1)** instruction.
DT90105	DT9105			
DT90106	DT9106	**High-speed counter target value area for ch2**		The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction **F166** to **F170** is executed. These preset values can only be read, and cannot be written.
DT90107	DT9107			

12.6 Table of Special Data Registers

Address		Name	Description
FP0 T32	**FP0 C10, C14, C16, C32, SL1**		
DT90108	**DT9108**	**High-speed counter elapsed value area for ch3**	The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the **ED** instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9108 and DT9109/DT90108 and DT90109. The value can be written by executing a **DMV (F1)** instruction.
DT90109	**DT9109**		
DT90110	**DT9110**	**High-speed counter target value area for ch3**	The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction **F166** to **F170** is executed. These preset values can only be read, and cannot be written.
DT90111	**DT9111**		

12.7 Error Codes

Error Confirmation When ERROR LED Turns ON

When the "ERROR LED (ERROR/ALARM LED)" on the control unit (CPU unit) turns on, a self-diagnostic error or syntax check error has occurred. Confirm the contents of the error and take the appropriate steps.

● Error Confirmation Method

Procedure:

1. Use the programming tool software to call up the error code.
   By executing the "STATUS DISPLAY", the error code and content of error are displayed.
2. Check the error contents in the table of error codes using the error code ascertained above.

● Syntax check error

This is an error detected by the total check function when there is a syntax error or incorrect setting written in the program. When the mode selector is switched to the RUN mode, the total check function automatically activates and eliminates the possibility of incorrect operation from syntax errors in the program.

When a syntax check error is detected

- ERROR LED (ERROR/ALARM LED) turns on.
- Operation will not begin even after switching to the RUN mode.
- Remote operation cannot be used to change to RUN mode.

Clearing a syntax check error

By changing to the PROG. mode, the error will clear and the ERROR LED (ERROR/ALARM LED) will turn off.

Steps to take for syntax error

Change to the PROG. mode, and then execute the total check function while online mode with the programming tool connected. This will call up the content of error and the address where the error occurred.
Correct the program while referring to the content of error.

● Self-diagnostic Error

This error occurs when the control unit (CPU unit) self-diagnostic function detects the occurrence of an abnormality in the system. The self-diagnostic function monitors the memory abnormal detection, I/O abnormal detection, and other devices.

When a self-diagnostic error occurs

The ERROR LED (ERROR/ALARM LED) turns on.

The operation of the control unit (CPU unit) might stop depending on the content of error and the system register setting.

The error codes will be stored in the special data register DT9000 (DT90000).

In the case of operation error, the error address will be stored in the DT9017 (DT90017) and DT9018 (DT90018).

Clearing the self-diagnostic error

At the “STATUS DISPLAY”, execute the “error clear”. Error codes 43 and higher can be cleared.

- You can use the initialize/test switch to clear an error. However, this will also clear the contents of operation memory.
- Errors can also be cleared by turning off and on the power while in the PROG. mode. However, the contents of operation memory, not stored with the hold type data, will also be cleared.
- The error can also be cleared depending on the self-diagnostic error set instruction **F148 (ERR)**.

Steps to take for self-diagnostic error

The steps to be taken will differ depending on the error contents. For more details, use the error code obtained above and consult the table of self-diagnostic error codes.

MEWTOCOL-COM Transmission Errors

These are error codes from a PC or other computer device that occur during an abnormal response when communicating with a PLC using MEWTOCOL-COM.

J Table of Syntax Check Error

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E1	**Syntax error**	Stops	A program with a syntax error has been written. **Change to PROG. mode and correct the error.**	A	A	A	A	A	A	A	A
E2 (* Note)	**Duplicated output error**	Stops	Two or more **OT(Out)** instructions and **KP(Keep)** instructions are programmed using the same relay. Also occurs when using the same timer/counter number. **Change to PROG. mode and correct the program so that one relay is not used for two or more OT instructions and KP instructions. Or, set the duplicated output to “enable” in system register 20. A timer/counter instruction double definition error will be detected even if double output permission has been selected.**	A	A	A	A	A	A	A	A
E3	**Not paired error**	Stops	For instructions which must be used in a pair such as jump (**JP** and **LBL**), one instruction is either missing or in an incorrect position. **Change to PROG. mode and enter the two instructions which must be used in a pair in the correct positions.**	A	A	A	A	A	A	A	A
E4	**Parameter mismatch error**	Stops	An instruction has been written which does not agree with system register settings. For example, the number setting in a program does not agree with the timer/counter range setting. **Change to PROG. mode, check the system register settings, and change so that the settings and the instruction agree.**	A	A	A	A	A	A	A	A
E5 (* Note)	**Program area error**	Stops	An instruction which must be written to a specific area (main program area or subprogram area) has been written to a different area (for example, a subroutine **SUB** to **RET** is placed before an **ED** instruction). **Change to PROG. mode and enter the instruction into the correct area.**	A	A	A	A	A	A	A	A
E6	**Compile memory full error**	Stops	The program is too large to compile in the program memory. **Change to PROG. mode and reduce the total number of steps for the program.** **FP2SH and FP10SH** **If memory expansion is possible, compilation will become possible when the memory is expanded.**	A	A	A	A		A	A	

A: Available

Note

This error is also detected if you attempt to execute a rewrite containing a syntax error during RUN. In this case, nothing will be written to the CPU and operation will continue.

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E7	**High-level instruc-tion type error**	Stops	In the program, high-level instructions, which execute in every scan and at the leading edge of the trigger, are programmed to be triggered by one contact [e.g., **F0 (MV)** and **P0 (PMV)** are programmed using the same trigger continuously]. **Correct the program so that the high-level instructions executed in every scan and only at the leading edge are triggered separately.**			A		A	A	A	A
E8	**High-level instruc-tion oper-and error**	Stops	There is an incorrect operand in an instruction which requires a specific combination operands (for example, the operands must all be of a certain type). **Enter the correct combination of operands.**	A	A	A	A	A	A	A	A
E9	**No progra error**	Stops	Program may be damaged. **Try to send the program again.**						A	A	
E10	**Rewrite during RUN syntax error**	Continues	When inputting with the programming tool software, a deletion, addition or change of order of an instruction (**ED**, **LBL**, **SUB**, **RET**, **INT**, **IRET**, **SSTP**, and **STPE**) that cannot perform a rewrite during RUN is being attempted. Nothing is written to the CPU.					A	A	A	A

A: Available

J Table of Self-Diagnostic Error

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E20	**CPU error**	Stops	Probably a hardware abnormality. **Please contact your dealer.**					A	A	A	A
E21	**RAM error 1**	Stops	Probably an abnormality in the internal RAM. **Please contact your dealer.**					A	A	A	A
E22	**RAM error 2**										
E23	**RAM error 3**										
E24	**RAM error 4**										
E25	**RAM error 5**										
E26	**User's ROM error**	Stops	FP-e, FP0, FPΣ, and FP1 C14, C16: Probably a hardware abnormality. **Please contact your dealer.** FP1 C24, C40, C56, C72, and FP-M: Probably an abnormality in the memory unit .**Program the memory unit again and try to operate. If the same error is detected, try to operate with another memory unit.** FP2, FP2SH, FP10SH, and FP3: There may be a problem with the installed ROM. - ROM is not installed. - ROM contents are damaged - Program size stored on the ROM is larger than the capacity of the ROM **Check the contents of the ROM**	A	A	A	A	A	A	A	A
E27	**Unit installation error**	Stops	Units installed exceed the limitations (i.e., 4 or more link units) **Turn off the power and re-configure units referring to the hardware manual.**			A		A	A	A	A
E28	**System register error**	Stops	Probably an abnormality in the system register. **Check the system register setting or initialize the system registers.**					A			A
E29	**Configuration parameter error**	Stops	A parameter error was detected in the MEWNET-W2 configuration area. Set a correct parameter.					A	A		
E30	**Interrupt error 0**	Stops	Probably a hardware abnormality. **Please contact your dealer.**								A
E31	**Interrupt error 1**	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. **Turn off the power and check the noise conditions.**	A	A	A	A	A	A	A	A

A: Available

12.7 Error Codes

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E32	**Interrupt error 2**	Stops	There is no interrupt program for an interrupt which occurred. **Check the number of the interrupt program and change it to agree with the interrupt request.**	A	A	A	A	A	A	A	A
E33	**Multi-CPU data unmatch error**	CPU2 Stops	This error occurs when a FP3/FP10SH is used as CPU2 for a multi-CPU system. **Refer to "Multi-CPU system Manual".**							A	A
E34	**I/O status error**	Stops	An abnormal unit is installed. **FPΣ, FP2, FP2SH and FP10SH:** **Check the contents of special data register DT90036 and locate the abnormal unit. Then turn off the power and replace the unit with a new one.** **FP3:** **Check the contents of special data register DT9036 and locate the abnormal unit. Then turn off the power and replace the unit with a new one.**			A	A		A	A	A
E35	**MEWNET-F slave illegal unit error**	Stops	A unit, which cannot be installed on the slave station of the MEWNET-F link system, is installed on the slave station. **Remove the illegal unit from the slave station.**					A	A	A	A
E36	**MEWNET-F (remote I/O) limitation error**	Stops	The number of slots or I/O points used for MEWNET-F (remote I/O) system exceeds the limitation. **Re-configure the system so that the number of slots and I/O points is within the specified range.**					A	A	A	A
E37	**MEWNET-F I/O mapping error**	Stops	I/O overlap or I/O setting that is over the range is detected in the allocated I/O and MEWNET-F I/O map. **Re-configure the I/O map correctly.**					A	A	A	A
E38	**MEWNET-F slave I/O terminal mapping error**	Stops	I/O mapping for remote I/O terminal boards, remote I/O terminal units and I/O link unit is not correct. **Re-configure the I/O map for slave stations according to the I/O points of the slave stations.**					A	A	A	A

A: Available

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E39	**IC card read error**	Stops	When reading in the program from the IC memory card (due to automatic reading because of the dip switch setting or program switching due to **F14 (PGRD)** instruction): - IC memory card is not installed. - There is no program file or it is damaged. - Writing is disabled. - There is an abnormality in the AUTOEXEC.SPG file. - Program size stored on the card is larger than the capacity of the CPU. **Install an IC memory card that has the program properly recorded and execute the read once again.**						A	A	
E40	**I/O error**	Selectable	Abnormal I/O unit **FPΣ:** **Check the contents of special data register DT90002 and abnormal FPΣ expansion unit. Then check the unit.** **FP2 and FP2SH:** **Check the contents of special data registers DT90002, DT90003 and abnormal I/O unit. Then check the unit.** **Selection of operation status using system register 21:** **- to continue operation, set 1** **- to stop operation, set 0** **Verification is possible in FPWIN GR/Pro at "I/O error" in the status display function.** MEWNET-TR communication error **FP3 and FP10SH:** **Check the contents of special data registers (FP3: DT9002, DT9003, FP10SH: DT90002, DT90003) and the erroneous master unit and abnormal I/O unit. Then check the unit.** **Selection of operation status using system register 21:** **- to continue operation, set 1** **- to stop operation, set 0** **Verification is possible in FPWIN GR/Pro at "I/O error" in the status display function.**			A		A	A	A	A

A: Available

12.7 Error Codes

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E41	**Intelligent unit error**	Selectable	An abnormality in an intelligent unit. **FPΣ:** **Check the contents of special data registers DT90006 and locate the abnormal FPΣ intelligent unit.** **FP2, FP2H, and FP10SH:** **Check the contents of special data registers DT90006, DT90007 and locate the abnormal intelligent unit. Then check the unit referring to its manual.** **Selection of operation status using system register 22:** **- to continue operation, set 1** **- to stop operation, set 0** **FP3:** **Check the contents of special data registers DT9006, DT9007 and locate the abnormal intelligent unit. Then check the unit referring to its manual.** **Selection of operation status using system register 22:** **- to continue operation, set 1** **- to stop operation, set 0** **Verification is possible in FPWIN GR/Pro at “Intelligent unit error“ in the status display function.**			A		A	A	A	A
E42	**I/O unit verify error**	Selectable	I/O unit wiring condition has changed compared to that at time of power-up. **Check the contents of special data register (FP0: DT90010, FPΣ: DT90011) and locate the erroneous expansion unit.** **Check the contents of special data registers (FP2, FP2SH, and FP10SH: DT90010, DT90011, FP3: DT9010, DT9011).** **Selection of operation status using system register 23:** **- to continue operation, set 1** **- to stop operation, set 0** **Verification is possible in FPWIN GR/Pro at “Verify error“ in the status display function.**			A		A	A	A	A
E43	**System watching dog timer error**	Selectable	Scan time required for program execution exceeds the setting of the system watching dog timer. **Check the program and modify it so that the program can execute a scan within the specified time.** **Selection of operation status using system register 24:** **- to continue operation, set 1** **- to stop operation, set 0**						A	A	

A: Available

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E44	**Slave station connecting time error for MEWNET-F system**	Selectable	The time required for slave station connection exceeds the setting of the system register 35. **Selection of operation status using system register 25:** **- to continue operation, set 1** **- to stop operation, set 0**					A	A	A	A
E45	**Operation error**	Selectable	Operation became impossible when a high-level instruction was executed. **Selection of operation status using system register 26:** **- to continue operation, set K1** **- to stop operation, set K0** **In the FP2, FP2H, and FP10SH,** **Check the contents of special data registers DT90017, DT90018 to find the instruction address where the operation error occurred. Then correct the program.** **In the FP3,** **Check the contents of special data registers DT9017, and DT9018 to find the instruction address where the operation error occurred. Then correct the program.** Verification is possible in FPWIN GR/Pro at "Operation error" in the status display function.	A	A	A	A	A	A	A	A
E46	**Remote I/O communication error**	Selectable	S-LINK error Occurs only in FP0-SL1 When one of the S-LINK errors (ERR 1, 3 or 4) has been detected, error code E46 (remote I/O (S-LINK) communication error) is stored. **Selection of operation status using system register 27:** **- to continue operation, set K1** **- to stop operation, set K0**	A							
		Selectable	MEWNET-F communication error A communication abnormally was caused by a transmission cable or during the power-down of a slave station. **FP2, FP2H, and FP10SH:** **Check the contents of special data registers DT90131 to DT90137 and locate the abnormal slave station and recover the communication condition.** **FP3:** **Check the contents of special data registers DT9131 to DT9137 and locate the abnormal slave station and recover the communication condition.** **Selection of operation status using system register 27:** **- to continue operation, set K1** **- to stop operation, set K0**				A	A	A	A	A

A: Available

12.7 Error Codes

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E47	**MEWNET-F attribute error**	Selectable	In the unit on the slave station, an abnormality such as: - missing unit - abnormal intelligent unit was detected. **FP2, FP2H, and FP10SH:** **Check the contents of special data registers DT90131 to DT90137 and locate the abnormal slave station and recover the slave condition.** **FP3:** **Check the contents of special data registers DT9131 to DT9137 and locate the abnormal slave station and recover the slave condition.** **Selection of operation status using system register 28:** **- to continue operation, set 1** **- to stop operation, set 0**					A	A	A	A
E50	**Backup battery error**	Continues	The voltage of the backup battery lowered or the backup battery of control unit is not installed. **Check the installation of the backup battery and then replace battery if necessary.** **By setting the system register 4, you can disregard this self-diagnostic error.**		A	A	A Note)	A	A	A	A
E51	**MEWNET-F terminal station error**	Continues	Terminal station settings were not properly performed. **Check stations at both ends of the communication path, and set them in the terminal station using the dip switches.**					A	A	A	A
E52	**MEWNET-F I/O update synchronous error**	Continues	**Set the INITIALIZE/TEST selector to the INITIALIZE position while keeping the mode selector in the RUN position. If the same error occurs after this, please contact your dealer.**					A	A	A	A
E53	**Multi-CPU I/O registration error (CPU2 only)**	Continues	Abnormality was detected when the multi-CPU system was used. **Please contact your dealer.**							A	A
E54	**IC memory card backup battery error**	Continues	The voltage of the backup battery for the IC memory card lowered. The BATT. LED does not turn on. **Charge or replace the backup battery of IC memory card. (The contents of the IC memory card cannot be guaranteed.)**						A	A	

A: Available

☞ **Note**

Available PLC: FP1 C24, C40, C56, C72, and FP-M

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FPΣ	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E55	**IC memory card back-up battery error**	Continues	The voltage of the backup battery for IC memory card lowers. The BATT. LED does not turn on **Charge or replace the backup battery of IC memory card. (The contents of the IC memory card cannot be guaranteed.)**						A	A	
E56	**Incompat-ible IC memory card error**	Continues	The IC memory card installed is not com-patible. **Replace the IC memory card compat-ible with FP2SH/FP10SH.**						A	A	
E57	**No unit for the con-figuration**	Continues	MEWNET-W2 The MEWNET-W2 link unit is not installed in the slot specified using the configuration data. **Either install a unit in the specified slot or change the parameter.**					A	A		
E100 to E199	**Self- diag-nostic error set by F148 (ERR)/P148 (PERR) instruction**	Stops	The error specified by the **F148 (ERR)/P148 (PERR)** instruction is oc-curred. **Take steps to clear the error condition according to the specification you chose.**	A	A	A	A	A			
E200 to E299		Continues		A	A	A	A	A			

A: Available

J Table of MEWTOCOL-COM Communication Error

Error code	Name	Description
!21	NACK error	Link system error
!22	WACK error	Link system error
!23	Unit No. overlap	Link system error
!24	Transmission format error	Link system error
!25	Link unit hardware error	Link system error
!26	Unit No. setting error	Link system error
!27	No support error	Link system error
!28	No response error	Link system error
!29	Buffer closed error	Link system error
!30	Time-out error	Link system error
!32	Transmission impossible error	Link system error
!33	Communication stop	Link system error
!36	No destination error	Link system error
!38	Other communica-tion error	Link system error
!40	BCC error	A transfer error occurred in the received data.
!41	Format error	A command was received that does not fit the format.
!42	No support error	A command was received that is not supported.
!43	Multiple frames procedure error	A different command was received when processing multiple frames.
!50	Link setting error	A route number that does not exist was specified. Verify the route number by designating the transmission station.
!51	Transmission time-out error	Transmission to another device not possible because transmission buffer is congested.
!52	Transmit disable error	Transmission processing to another device is not possible. (Link unit runaway, etc.)
!53	Busy error	Command process cannot be received because of multiple frame processing. Or, cannot be received because command being pro-cessed is congested.
!60	Parameter error	Content of specified parameter does not exist or cannot be used.
!61	Data error	There was a mistake in the contact, data area, data number desig-nation, size designation, range, or format designation.
!62	Registration over error	Operation was done when number of registrations was exceeded or when there was no registration.
!63	PC mode error	A command that cannot be processed was executed during RUN mode.

Error code	Name	Description
!64	External memory error	An abnormality occurred when loading RAM to ROM/IC memory card. There may be a problem with the ROM or IC memory card. - When loading, the specified contents exceeded the capacity. - Write error occurs. - ROM or IC memory card is not installed. - ROM or IC memory card does not conform to specifications - ROM or IC memory card board is not installed.
!65	Protect error	A program or system register write operation was executed when the protect mode (password setting or DIP switch, etc.) or ROM operation mode was being used.
!66	Address error	There was an error in the code format of the address data. Also, when exceeded or insufficient of address data, there was a mistake in the range designation.
!67	No program error and No data error	Cannot be read because there is no program in the program area or the memory contains an error. Or, reading was attempted of data that was not registered.
!68	Rewrite during RUN error	When inputting with the programming tool software, editing of an instruction (**ED**, **SUB**, **RET**, **INT**, **IRET**, **SSTP**, and **STPE**) that cannot perform a rewrite during RUN is being attempted. Nothing is written to the CPU.
!70	SIM over error	Program area was exceeded during a program write process.
!71	Exclusive access control error	A command that cannot be processed was executed at the same time as a command being processed.

12.8 Table of Instructions

12.8.1 Table of Basic Instructions

Name	Boolean	Symbol	Description	Steps (* 1)
Sequence basic instructions				
Start	**ST**	X,Y,R,T,C,L,P,E	Begins a logic operation with a Form A (normally open) contact.	1 (2)
Start Not	**ST/**	X,Y,R,T,C,L,P,E	Begins a logic operation with a Form B (normally closed) contact.	1 (2)
Out	**OT**	Y,R,L,E	Outputs the operated result to the specified output.	1 (2)
Not	**/**	—/—	Inverts the operated result up to this instruction.	1
AND	**AN**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact serially.	1 (2)
AND Not	**AN/**	X,Y,R,T,C,L,P,E	Connects a Form B (normally closed) contact serially.	1 (2)
OR	**OR**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact in parallel.	1 (2)
OR Not	**OR/**	X,Y,R,T,C,L,P,E	Connects a Form B (normally closed) contact in parallel.	1 (2)
Leading edge start	**ST↑**	X,Y,R,T,C,L,P,E	Begins a logic operation only for one scan when the leading edge of the trigger is detected.	2
Trailing edge start	**ST↓**	X,Y,R,T,C,L,P,E	Begins a logic operation only for one scan when the trailing edge of the trigger is detected.	2

Name	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Sequence basic instructions												
Start	A	A	A	A	A	A	A	A	A	A	A	A
Start Not	A	A	A	A	A	A	A	A	A	A	A	A
Out	A	A	A	A	A	A	A	A	A	A	A	A
Not	A	A	A	A	A	A	A	A	A	A	A	A
AND	A	A	A	A	A	A	A	A	A	A	A	A
AND Not	A	A	A	A	A	A	A	A	A	A	A	A
OR	A	A	A	A	A	A	A	A	A	A	A	A
OR Not	A	A	A	A	A	A	A	A	A	A	A	A
Leading edge start	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge start	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **In the FP2/FP2SH/FP10SH, when using X1280, Y1280, R1120 (special internal relay included), L1280, T256, C256 or anything beyond for the ST, ST/, OT, AN, AN/, OR and OR/ instructions, the number of steps is shown in parentheses. Also, in the FP2/FP2SH/FP10SH, when a relay number has an index modifier, the number of steps is shown in parentheses.**

Name	Boolean	Symbol	Description	Steps
Leading edge AND	**AN↑**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact serially only for one scan when the leading edge of the trigger is detected.	2
Trailing edge AND	**AN↓**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact serially only for one scan when the trailing edge of the trigger is detected.	2
Leading edge OR	**OR↑**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact in parallel only for one scan when the leading edge of the trigger is detected.	2
Trailing edge OR	**OR↓**	X,Y,R,T,C,L,P,E	Connects a Form A (normally open) contact in parallel only for one scan when the trailing edge of the trigger is detected.	2
Leading edge out	**OT↑**	P	Outputs the operated result to the specified output only for one scan when leading edge of the trigger is detected. (for pulse relay)	2
Trailing edge out	**OT↓**	P	Outputs the operated result to the specified output only for one scan when trailing edge of the trigger is detected. (for pulse relay)	2
Alternative out	**ALT**	Y,R,L,E A	Inverts the output condition (on/off) each time the leading edge of the trigger is detected.	3
AND stack	**ANS**		Connects the multiple instruction blocks serially.	1
OR stack	**ORS**		Connects the multiple instruction blocks in parallel.	1
Push stack	**PSHS**		Stores the operated result up to this instruction.	1
Read stack	**RDS**		Reads the operated result stored by the **PSHS** instruction.	1
Pop stack	**POPS**		Reads and clears the operated result stored by the **PSHS** instruction.	1
Leading edge differ-ential	**DF**	(DF)	Turns on the contact for only one scan when the leading edge of the trigger is detected.	1
Trailing edge differ-ential	**DF/**	(DF/)	Turns on the contact for only one scan when the trailing edge of the trigger is detected.	1

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Leading edge AND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge AND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Leading edge OR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge OR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Leading edge out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Alternative out	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
AND stack	A	A	A	A	A	A	A	A	A	A	A	A
OR stack	A	A	A	A	A	A	A	A	A	A	A	A
Push stack	A	A	A	A	A	A	A	A	A	A	A	A
Read stack	A	A	A	A	A	A	A	A	A	A	A	A
Pop stack	A	A	A	A	A	A	A	A	A	A	A	A
Leading edge differ-ential	A	A	A	A	A	A	A	A	A	A	A	A
Trailing edge differ-ential	A	A	A	A	A	A	A	A	A	A	A	A

Note

A: Available, N/A: Not available

12.8 Table of Instructions

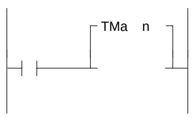
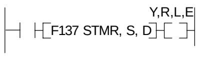
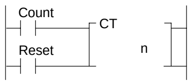
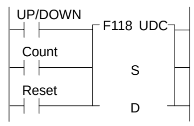
Name	Boolean	Symbol	Description	Steps (* 1)
Leading edge differential (initial execution type)	**DFI**	(DFI)	Turns on the contact for only one scan when the leading edge of the trigger is detected. The leading edge detection is possible on the first scan.	1
Set	**SET**	Y,R,L,E < S >	Output is set to and held at on.	3
Reset	**RST**	Y,R,L,E < R >	Output is set to and held at off.	3
Keep	**KP**	Set Reset KP	Outputs at set trigger and holds until reset trigger turns on.	1 (2)
No operation	**NOP**	●	No operation.	1

Name	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Leading edge differential (initial execution type)	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Set	A	A	A	A	A	A	A	A	A	A	A	A
Reset	A	A	A	A	A	A	A	A	A	A	A	A
Keep	A	A	A	A	A	A	A	A	A	A	A	A
No operation	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **In the FP2/FP2SH/FP10SH, when using Y1280, R1120 (special internal relay included), L1280 or anything beyond for the KP instruction, the number of steps is shown in parentheses. Also, in the FP2/FP2SH/FP10SH, when a relay number has an index modifier, the number of steps is shown in parentheses.**

Name	Boolean	Symbol	Description	Steps (* 1)
Basic function instructions				
On-delay timer	**TML**		After set value “n” × 0.001 seconds, timer contact “a” is set to on.	3 (4)
	TMR		After set value “n” × 0.01 seconds, timer contact “a” is set to on.	3 (4)
	TMX		After set value “n” × 0.1 seconds, timer contact “a” is set to on.	3 (4)
	TMY		After set value “n” × 1 second, timer contact “a” is set to on.	4 (5)
Auxiliary timer (16-bit)	**F137 (STMR)**		After set value “S” × 0.01 seconds, the specified output and R900D are set to on.	5
Auxiliary timer (32-bit)	**F183 (DSTM)**		After set value “S” × 0.01 seconds, the specified output and R900D are set to on.	7
Counter	**CT**		Decrements from the preset value “n”	3 (4)
UP/DOWN counter	**F118 (UDC)**		Increments or decrements from the preset value “S” based on up/down input.	5

Note

1) In the FP2/FP2SH/FP10SH, when timer 256 or higher, or counter 255 or lower, is used, the number of steps is the number in parentheses. Also, in the FP2/FP2SH/FP10SH, when a timer number or counter number has an index modifier, the number of steps is the number in parentheses.

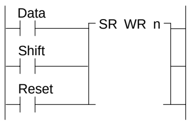
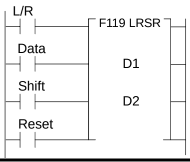
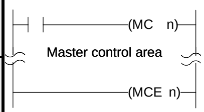
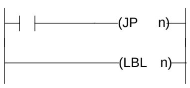
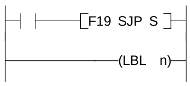
Name	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Basic function instructions												
On-delay timer TML	A (* 1)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
On-delay timer TMR	A	A	A	A	A	A	A	A	A	A	A	A
On-delay timer TMX	A	A	A	A	A	A	A	A	A	A	A	A
On-delay timer TMY	A	A	A	A	A	A	A	A	A	A	A	A
Auxiliary timer (16-bit)	A	A	A	N/A	N/A	A	N/A	A	A	A	A	A
Auxiliary timer (32-bit)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Counter	A	A	A	A	A	A	A	A	A	A	A	A
UP/DOWN counter	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) This instruction is available for FP0 C10, C14, C16, C32 CPU Ver. 2.0 or later/FP0 T32C.

12.8 Table of Instructions

Name	Boolean	Symbol	Description	Steps
Shift register	**SR**		Shifts one bit of 16-bit [word internal relay (WR)] data to the left.	1 (2) (* 1)
Left/right shift register	**F119 (LRSR)**		Shifts one bit of 16-bit data range specified by “D1” and “D2” to the left or to the right.	5
Control instructions				
Master control relay	**MC**		Starts the master control program.	2
Master control relay end	**MCE**		Ends the master control program.	2
Jump **Label**	**JP** **LBL**		The program jumps to the label instruction and continues from there.	2 (3) (* 2) 1
Auxiliary jump **Label**	**F19 (SJP)** **LBL**		The program jumps to the label instruction specified by “S” and continues from there.	3 1

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Shift register	A	A	A	A	A	A	A	A	A	A	A	A
Left/right shift register	A	A	A	A	A	A	A	A	A	A	A	A
Control instructions												
Master control relay	A	A	A	A	A	A	A	A	A	A	A	A
Master control relay end	A	A	A	A	A	A	A	A	A	A	A	A
Jump Label	A	A	A	A	A	A	A	A	A	A	A	A
Auxiliary jump Label	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A

Notes

- **A: Available, N/A: Not availble**

1) In the FP2/FP2SH/FP10SH, when internal relay WR240 or higher is used, the number of steps is the number in parentheses. Also, in the FP2/FP2SH/FP10SH, when the specified internal relay number (word address) has an index modifier, the number of steps is the number in parentheses.

2) In the FP2/FP2SH/FP10SH, when the number “n” in a jump instruction has an index modifier, the number of steps is the number in parentheses.

Name	Boolean	Symbol	Description	Steps
Loop **Label**	**LOOP** **LBL**	(LBL n) [LOOP n, S]	The program jumps to the label instruction and continues from there (the number of jumps is set in "S").	4 (5) (* 1) 1
Break	**BRK**	(BRK)	Stops program execution when the predetermined trigger turns on in the TEST/RUN mode only.	1
End	**ED**	(ED)	The operation of program is ended. Indicates the end of a main program.	1
Conditional end	**CNDE**	(CNDE)	The operation of program is ended when the trigger turns on.	1
Eject	**EJECT**	(EJECT)	Adds page break for use when printing.	1
Step ladder instructions				
Start step	**SSTP**	(SSTP n)	The start of program "n" for process control	3
Next step	**NSTL**	(NSTL n)	Start the specified process "n" and clear the process currently started. (Scan execution type)	3
	NSTP	(NSTP n)	Start the specified process "n" and clear the process currently started. (Pulse execution type)	3
Clear step	**CSTP**	(CSTP n)	Resets the specified process "n".	3
Clear multiple steps	**SCLR**	[SCLR n1, n2]	Resets multiple processes specified by "n1" and "n2."	5
Step end	**STPE**	(STPE)	End of step ladder area	1

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Loop **Label**	A	A	A	A	A	A	A	A	A	A	A	A
Break	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
End	A	A	A	A	A	A	A	A	A	A	A	A
Conditional end	A	A	A	A	A	A	A	A	A	A	A	A
EJECT	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Step ladder instructions												
Start step	A	A	A	A	A	A	A	A	A	A	A	A
Next step NSTL	A	A	A	A	A	A	A	A	A	A	A	A
Next step NSTP	A	A	A	A	A	A	A	A	A	A	A	A
Clear step	A	A	A	A	A	A	A	A	A	A	A	A
Clear multi-ple steps	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Step end	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **In the FP2/FP2SH/FP10SH, when the number “n” in a loop instruction has an index modifier, the number of steps is the number in parentheses.**

Name	Boolean	Symbol	Description	Steps
Subroutine instructions				
Subroutine call	**CALL**	(CALL n)	Executes the specified subroutine. When returning to the main program, outputs in the subroutine program are maintained.	2 (3) (* 1)
Output off type subrou-tine call	**FCAL**	(FCAL n)	Executes the specified subroutine. When returning to the main program, all outputs in the subroutine program are set to off.	4 (5) (* 1)
Subroutine entry	**SUB**	(SUB n)	Indicates the start of the subroutine program "n".	1
Subroutine return	**RET**	(RET)	Ends the subroutine program.	1
Interrupt instructions				
Interrupt	**INT**	(INT n)	Indicates the start of the interrupt program "n".	1
Interrupt return	**IRET**	(IRET)	Ends the interrupt program.	1
Interrupt control	**ICTL**	(DF) [ICTL S1, S2]	Select interrupt enable/disable or clear in "S1" and "S2" and execute.	5

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Subroutine instructions												
Subroutine call	A	A	A	A	A	A	A	A	A	A	A	A
Output off type subroutine call	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
Subroutine entry	A	A	A	A	A	A	A	A	A	A	A	A
Subroutine return	A	A	A	A	A	A	A	A	A	A	A	A
Interrupt instructions												
Interrupt	A	A	A	N/A	A	A	A	A	A	A	A	A
Interrupt return	A	A	A	N/A	A	A	A	A	A	A	A	A
Interrupt control	A	A	A	N/A	A	A	N/A (* 2)	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **In the FP2/FP2SH/FP10SH, when the number “n” of a subroutine program has an index modifier, the number of steps is the number in parentheses.**
2) **The ICTL instruction cannot be used with the FP-M C16T. (Interrupt masking and clearing are not possible.)
The interrupt operation is possible using the interrupt setting of the system register 403.**

12.8 Table of Instructions

Name	Boolean	Symbol	Description	Steps
Special setting instructions				
Communication conditions setting	**SYS1**	├┤ ├ (DF) ─[SYS1, M]	Change the communication conditions for the COM port or tool port based on the contents specified by the character constant.	13
Password setting			Change the password specified by the PLC based on the contents specified by the character constant.	
Interrupt setting			Set the interrupt input based on the contents specified by the character constant.	
PLC link time setting			Set the system setting time when a PLC link is used, based on the contents specified by the character constant.	
MEWTOCOL - COM response control			Change the communication conditions of the COM. port or tool port for MEWTOCOL - COM based on the contents specified by the character constant.	
System registers "No. 40 to No. 47" changing	**SYS2**	├┤ ├[SYS2, S, D1, D2]	Change the setting value of the system register for the PLC link function.	7

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Communication conditions setting	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Password setting	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interrupt setting	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PLC link time setting	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MEWTOCOL-COM response control	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
System registers “No. 40 to No. 47” changing	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

12.8 Table of Instructions

Name	Boolean	Symbol	Description	Steps
Data compare instructions				
16-bit data compare (Start)	**ST=**	= S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1=S2.”	5
	ST<>	< > S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2.”	5
	ST>	> S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2.”	5
	ST>=	> = S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2” or “S1 = S2.”	5
	ST<	< S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2.”	5
	ST<=	< = S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2.”	5

Name	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Data compare instructions												
16-bit data compare (Start) **ST=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) **ST<>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) **ST>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) **ST>=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) **ST<**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) **ST<=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

Name	Boolean	Symbol	Description	Steps
16-bit data compare (AND)	**AN=**	= S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1=S2.”	5
	AN<>	< > S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2.”	5
	AN>	> S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1>S2.”	5
	AN>=	> = S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2.”	5
	AN<	< S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2.”	5
	AN<=	< = S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1 < S2” or “S1 =S2.”	5

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
16-bit data compare (AND) AN=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN>=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<=	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

Name	Boolean	Symbol	Description	Steps
16-bit data compare (OR)	**OR=**	= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1=S2.”	5
	OR<>	< > S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2.”	5
	OR>	> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1>S2.”	5
	OR>=	> = S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2.”	5
	OR<	< S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2.”	5
	OR<=	< = S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2.”	5

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
16-bit data compare (OR) OR=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR>=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<=	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

Name	Boolean	Symbol	Description	Steps
32-bit data compare (Start)	**STD=**	D= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2).”	9
	STD<>	D< > S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2).”	9
	STD>	D> S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2).”	9
	STD>=	D> = S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2).”	9
	STD<	D< S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2).”	9
	STD<=	D< = S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2).”	9

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
32-bit data compare (Start) STD=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD>	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD>=	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<=	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

Name	Boolean	Symbol	Description	Steps
32-bit data compare (AND)	**AND=**	D= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)=(S2+1, S2)."	9
	AND<>	D< > S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)<(S2+1, S2)" or "(S1+1, S1)>(S2+1, S2)."	9
	AND>	D> S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)>(S2+1, S2)."	9
	AND>=	D> = S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)>(S2+1, S2)" or "(S1+1, S1)=(S2+1, S2)."	9
	AND<	D< S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)<(S2+1, S2)."	9
	AND<=	D< = S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition "(S1+1, S1)<(S2+1, S2)" or "(S1+1, S1)=(S2+1, S2)."	9

Name	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
32-bit data compare (AND) **AND=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) **AND<>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) **AND>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) **AND>=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) **AND<**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) **AND<=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

Name	Boolean	Symbol	Description	Steps
32-bit data compare (OR)	**ORD=**	D= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2).”	9
	ORD<>	D< > S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2).”	9
	ORD>	D> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2).”	9
	ORD>=	D> = S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2).”	9
	ORD<	D< S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2).”	9
	ORD<=	D< = S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2).”	9

Name	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
32-bit data compare (OR) **ORD=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) **ORD<>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) **ORD>**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) **ORD>=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) **ORD<**	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) **ORD<=**	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note

- **A: Available, N/A: Not available**

12.8.2 Table of High-level Instructions

The high-level instructions are expressed by the prefixes “F” or “P” with numbers. For most of the high-level instructions, “F” and “P” types are available. The differences between the two types are explained as follows:

- Instructions with the prefix “F” are executed in every scan while its trigger is in the on.
- Instructions with the prefix “P” are executed only when the leading edge of its trigger is detected.

Number	Name	Boolean	Operand	Description	Steps
Data transfer instructions					
F0 **P0**	**16-bit data move**	**MV** **PMV**	S, D	(S) → (D)	5
F1 **P1**	**32-bit data move**	**DMV** **PDMV**	S, D	(S+1, S) → (D+1, D)	7
F2 **P2**	**16-bit data invert and move**	**MV/** **PMV/**	S, D	($\overline{S}$) → (D)	5
F3 **P3**	**32-bit data invert and move**	**DMV/** **PDMV/**	S, D	($\overline{S+1, S}$) → (D+1, D)	7
F5 **P5**	**Bit data move**	**BTM** **PBTM**	S, n, D	The specified one bit in “S” is transferred to the specified one bit in “D.” The bit is specified by “n.”	7
F6 **P6**	**Hexadecimal digit (4-bit) data move**	**DGT** **PDGT**	S, n, D	The specified one digit in “S” is transferred to the specified one digit in “D.” The digit is specified by “n.”	7
F7 **P7**	**Two 16-bit data move**	**MV2** **PMV2**	S1, S2, D	(S1) → (D), (S2) → (D+1)	7
F8 **P8**	**Two 32-bit data move**	**DMV2** **PDMV2**	S1, S2, D	(S1+1, S1) → (D+1, D), (S2+1, S2) → (D+3, D+2)	11
F10 **P10**	**Block move**	**BKMV** **PBKMV**	S1, S2, D	The data between “S1” and “S2” is transferred to the area starting at “D.”	7
F11 **P11**	**Block copy**	**COPY** **PCOPY**	S, D1, D2	The data of “S” is transferred to the all area between “D1” and “D2.”	7

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Data transfer instructions												
F0 P0	A	A	A	A	A	A	A	A	A	A	A	A
F1 P1	A	A	A	A	A	A	A	A	A	A	A	A
F2 P2	A	A	A	A	A	A	A	A	A	A	A	A
F3 P3	A	A	A	A	A	A	A	A	A	A	A	A
F5 P5	A	A	A	A	A	A	A	A	A	A	A	A
F6 P6	A	A	A	A	A	A	A	A	A	A	A	A
F7 P7	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F8 P8	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F10 P10	A	A	A	A	A	A	A	A	A	A	A	A
F11 P11	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
F12 **P12**	**Data read from IC card/ ROM**	**ICRD** **PICRD**	S1, S2, D	The data stored in the expansion memory of the IC card or ROM specified by "S1" and "S2" are transferred to the area starting at "D."	11
F12		**ICRD**			
F13 **P13**	**Data write to IC card/ROM**	**ICWT** **PICWT**	S1, S2, D	The data specified by "S1" and "S2" are transferred to the IC card expansion memory area or ROM starting at "D."	11
P13		**PICWT**			
F14 **P14**	**Program read from IC memory card**	**PGRD** **PPGRD**	S	The program specified using "S" is transferred into the CPU from IC memory card and executes it.	3
F15 **P15**	**16-bit data exchange**	**XCH** **PXCH**	D1, D2	(D1) → (D2), (D2) → (D1)	5
F16 **P16**	**32-bit data exchange**	**DXCH** **PDXCH**	D1, D2	(D1+1, D1) → (D2+1, D2) (D2+1, D2) → (D1+1, D1)	5
F17 **P17**	**Higher/ lower byte in 16-bit data exchange**	**SWAP** **PSWAP**	D	The higher byte and lower byte of "D" are exchanged.	3
F18 **P18**	**16-bit data block exchange**	**BXCH** **PBXCH**	D1, D2, D3	Exchange the data between "D1" and "D2" with the data specified by "D3."	7
Control instruction					
F19	**Auxiliary jump**	**SJP**	S	The program jumps to the label instruction specified by "S" and continues from there.	3
Binary arithmetic instructions					
F20 **P20**	**16-bit data addition**	**+** **P+**	S, D	(D) + (S) → (D)	5
F21 **P21**	**32-bit data addition**	**D+** **PD+**	S, D	(D +1, D) + (S+1, S) → (D+1, D)	7
F22 **P22**	**16-bit data addition**	**+** **P+**	S1, S2, D	(S1) + (S2) → (D)	7
F23 **P23**	**32-bit data addition**	**D+** **PD+**	S1, S2, D	(S1+1, S1) + (S2+1, S2) → (D+1, D)	11

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP- e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F12 P12	——	——	——	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F12	A(* 2)	A	A									
F13 P13	——	——	——	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
P13	A (* 2)	A	A									
F14 P14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F15 P15	A	A	A	A	A	A	A	A	A	A	A	A
F16 P16	A	A	A	A	A	A	A	A	A	A	A	A
F17 P17	A	A	A	A	A	A	A	A	A	A	A	A
F18 P18	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Control instruction												
F19	N/A	N/A	N/A	M/A	N/A	N/A	N/A	N/A	A	A	A	A
Binary arithmetic instructions												
F20 P20	A	A	A	A	A	A	A	A	A	A	A	A
F21 P21	A	A	A	A	A	A	A	A	A	A	A	A
F22 P22	A	A	A	A	A	A	A	A	A	A	A	A
F23 P23	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions except for P13 (PICWT) instruction are not available.**
2) **This instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.**

12.8 Table of Instructions

Num-ber	Name	Boolean	Operand	Description	Steps
F25 **P25**	**16-bit data subtraction**	**-** **P-**	S, D	(D) - (S) → (D)	5
F26 **P26**	**32-bit data subtraction**	**D-** **PD-**	S, D	(D+1, D) - (S+1, S) → (D+1, D)	7
F27 **P27**	**16-bit data subtraction**	**-** **P-**	S1, S2, D	(S1) - (S2) → (D)	7
F28 **P28**	**32-bit data subtraction**	**D-** **PD-**	S1, S2, D	(S1+1, S1) - (S2+1, S2) → (D+1, D)	11
F30 **P30**	**16-bit data multiplication**	***** **P***	S1, S2, D	(S1) × (S2) → (D+1, D)	7
F31 **P31**	**32-bit data multiplication**	**D*** **PD***	S1, S2, D	(S1+1, S1) × (S2+1, S2) → (D+3, D+2, D+1, D)	11
F32 **P32**	**16-bit data division**	**%** **P%**	S1, S2, D	(S1) ÷ (S2) → quotient (D) remainder (DT9015 for FP0/FP-e/FP1/FP-M/FP3 or DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	7
F33 **P33**	**32-bit data division**	**D%** **PD%**	S1, S2, D	(S1+1, S1) ÷ (S2+1, S2) → quotient (D+1, D) remainder (DT9016, DT9015 for FP0/FP-e/FP1/FP-M/FP3 or DT90016, DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	11
F34 **P34**	**16-bit data multiplication (result in 16 bits)**	***W** **P*W**	S1, S2, D	(S1) × (S2) → (D)	7
F35 **P35**	**16-bit data increment**	**+1** **P+1**	D	(D) + 1 → (D)	3
F36 **P36**	**32-bit data increment**	**D+1** **PD+1**	D	(D+1, D) + 1 → (D+1, D)	3

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP - e(* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F25 P25	A	A	A	A	A	A	A	A	A	A	A	A
F26 P26	A	A	A	A	A	A	A	A	A	A	A	A
F27 P27	A	A	A	A	A	A	A	A	A	A	A	A
F28 P28	A	A	A	A	A	A	A	A	A	A	A	A
F30 P30	A	A	A	A	A	A	A	A	A	A	A	A
F31 P31	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F32 P32	A	A	A	A	A	A	A	A	A	A	A	A
F33 P33	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F34 P34	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F35 P35	A	A	A	A	A	A	A	A	A	A	A	A
F36 P36	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
F37 **P37**	**16-bit data decrement**	**-1** **P-1**	D	(D) - 1 → (D)	3
F38 **P38**	**32-bit data decrement**	**D-1** **PD-1**	D	(D+1, D) - 1 → (D+1, D)	3
F39 **P39**	**32-bit data multiplication (result in 32 bits)**	**D*D** **PD*D**	S1, S2, D	(S1+1, S1) × (S2+1, S2) → (D+1, D)	11
BCD arithmetic instructions					
F40 **P40**	**4-digit BCD data addition**	**B+** **PB+**	S, D	(D) + (S) → (D)	5
F41 **P41**	**8-digit BCD data addition**	**DB+** **PDB+**	S, D	(D+1, D) + (S+1, S) → (D+1, D)	7
F42 **P42**	**4-digit BCD data addition**	**B+** **PB+**	S1, S2, D	(S1) + (S2) → (D)	7
F43 **P43**	**8-digit BCD data addition**	**DB+** **PDB+**	S1, S2, D	(S1+1, S1) + (S2+1, S2) → (D+1, D)	11
F45 **P45**	**4-digit BCD data subtraction**	**B-** **PB-**	S, D	(D) - (S) → (D)	5
F46 **P46**	**8-digit BCD data subtraction**	**DB-** **PDB-**	S, D	(D+1, D) - (S+1, S) → (D+1, D)	7
F47 **P47**	**4-digit BCD data subtraction**	**B-** **PB-**	S1, S2, D	(S1) - (S2) → (D)	7

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	FP1 (* 1) C24 C40	FP1 (* 1) C56 C72	FP-M(*1) C16	FP-M(*1) C20 C32	FP3	FP2	FP2SH	FP10SH
F37 P37	A	A	A	A	A	A	A	A	A	A	A	A
F38 P38	A	A	A	A	A	A	A	A	A	A	A	A
F39 P39	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
BCD arithmetic instructions												
F40 P40	A	A	A	A	A	A	N/A	A	A	A	A	A
F41 P41	A	A	A	A	A	A	N/A	A	A	A	A	A
F42 P42	A	A	A	A	A	A	N/A	A	A	A	A	A
F43 P43	A	A	A	A	A	A	N/A	A	A	A	A	A
F45 P45	A	A	A	A	A	A	N/A	A	A	A	A	A
F46 P46	A	A	A	A	A	A	N/A	A	A	A	A	A
F47 P47	A	A	A	A	A	A	N/A	A	A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
F48 **P48**	**8-digit BCD data subtraction**	**DB-** **PDB-**	S1, S2, D	(S1+1, S1) - (S2+1, S2) → (D+1, D)	11
F50 **P50**	**4-digit BCD data multiplication**	**B*** **PB***	S1, S2, D	(S1) × (S2) → (D+1, D)	7
F51 **P51**	**8-digit BCD data multiplication**	**DB*** **PDB***	S1, S2, D	(S1+1, S1) × (S2+1, S2) → (D+3, D+2, D+1, D)	11
F52 **P52**	**4-digit BCD data division**	**B%** **PB%**	S1, S2, D	(S1) ÷ (S2) → quotient (D) remainder (DT9015 for FP0/FP-e/FP1/FP-M/FP3 or DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	7
F53 **P53**	**8-digit BCD data division**	**DB%** **PDB%**	S1, S2, D	(S1+1, S1) ÷ (S2+1, S2) → quotient (D+1, D) remainder (DT9016, DT9015 for FP0/FP-e/FP1/FP-M/FP3 or DT90016, DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	11
F55 **P55**	**4-digit BCD data increment**	**B+1** **PB+1**	D	(D) + 1 → (D)	3
F56 **P56**	**8-digit BCD data increment**	**DB+1** **PDB+1**	D	(D+1, D) + 1 → (D+1, D)	3
F57 **P57**	**4-digit BCD data decrement**	**B-1** **PB-1**	D	(D) - 1 → (D)	3
F58 **P58**	**8-digit BCD data decrement**	**DB-1** **PDB-1**	D	(D+1, D) - 1 → (D+1, D)	3

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e(* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F48 P48	A	A	A	A	A	A	N/A	A	A	A	A	A
F50 P50	A	A	A	A	A	A	N/A	A	A	A	A	A
F51 P51	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F52 P52	A	A	A	A	A	A	N/A	A	A	A	A	A
F53 P53	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F55 P55	A	A	A	A	A	A	N/A	A	A	A	A	A
F56 P56	A	A	A	A	A	A	N/A	A	A	A	A	A
F57 P57	A	A	A	A	A	A	N/A	A	A	A	A	A
F58 P58	A	A	A	A	A	A	N/A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.**

Number	Name	Boolean	Operand	Description	Steps
Data compare instructions					
F60 **P60**	**16-bit data compare**	**CMP** **PCMP**	S1, S2	(S1) > (S2) → R900A: on (S1) = (S2) → R900B: on (S1) < (S2) → R900C: on	5
F61 **P61**	**32-bit data compare**	**DCMP** **PDCMP**	S1, S2	(S1+1, S1) > (S2+1, S2) → R900A: on (S1+1, S1) = (S2+1, S2) → R900B: on (S1+1, S1) < (S2+1, S2) → R900C: on	9
F62 **P62**	**16-bit data band compare**	**WIN** **PWIN**	S1, S2, S3	(S1) > (S3) → R900A: on (S2) < or = (S1) < or = (S3) → R900B: on (S1) < (S2) → R900C: on	7
F63 **P63**	**32-bit data band compare**	**DWIN** **PDWIN**	S1, S2, S3	(S1+1, S1) > (S3+1, S3) → R900A: on (S2+1, S2)<or=(S1+1, S1)<or=(S3 + 1, S3) → R900B: on (S1+1, S1) < (S2+1, S2) → R900C: on	13
F64 **P64**	**Block data compare**	**BCMP** **PBCMP**	S1, S2, S3	Compares the two blocks beginning with "S2" and "S3" to see if they are equal.	7
Logic operation instructions					
F65 **P65**	**16-bit data AND**	**WAN** **PWAN**	S1, S2, D	(S1) AND (S2) → (D)	7
F66 **P66**	**16-bit data OR**	**WOR** **PWOR**	S1, S2, D	(S1) OR (S2) → (D)	7
F67 **P67**	**16-bit data exclusive OR**	**XOR** **PXOR**	S1, S2, D	{(S1) AND ($\overline{S2}$)} OR {($\overline{S1}$) AND (S2)} → (D)	7
F68 **P68**	**16-bit data exclusive NOR**	**XNR** **PXNR**	S1, S2, D	{(S1) AND (S2)} OR {($\overline{S1}$) AND ($\overline{S2}$)} → (D)	7
F69 **P69**	**16-bit data unite**	**WUNI** **PWUNI**	S1, S2, S3, D	([S1] AND [S3]) OR ([S2] AND [$\overline{S3}$]) → (D) When (S3) is H0, (S2) → (D) When (S3) is HFFFF, (S1) → (D)	9

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	FP1 (* 1) C24 C40	FP1 (* 1) C56 C72	FP-M(*1) C16	FP-M(*1) C20 C32	FP3	FP2	FP2SH	FP10SH
Data compare instructions												
F60 P60	A	A	A	A	A	A	A	A	A	A	A	A
F61 P61	A	A	A	A	A	A	A	A	A	A	A	A
F62 P62	A	A	A	A	A	A	A	A	A	A	A	A
F63 P63	A	A	A	A	A	A	A	A	A	A	A	A
F64 P64	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Logic operation instructions												
F65 P65	A	A	A	A	A	A	A	A	A	A	A	A
F66 P66	A	A	A	A	A	A	A	A	A	A	A	A
F67 P67	A	A	A	A	A	A	A	A	A	A	A	A
F68 P68	A	A	A	A	A	A	A	A	A	A	A	A
F69 P69	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Number	Name	Boolean	Operand	Description	Steps
Data conversion instructions					
F70 **P70**	**Block check code calculation**	**BCC** **PBCC**	S1, S2, S3, D	Creates the code for checking the data specified by “S2” and “S3” and stores it in “D.” The calculation method is specified by “S1.”	9
F71 **P71**	**Hexadecimal data → ASCII code**	**HEXA** **PHEXA**	S1, S2, D	Converts the hexadecimal data specified by “S1” and “S2” to ASCII code and stores it in “D.” Example: HABCD → H 42 41 44 43 B A D C	7
F72 **P72**	**ASCII code → Hexadecimal data**	**AHEX** **PAHEX**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to hexadecimal data and stores it in “D.” Example: H 44 43 42 41 → HCDAB D C B A	7
F73 **P73**	**4-digit BCD data → ASCII code**	**BCDA** **PBCDA**	S1, S2, D	Converts the four digits of BCD data specified by “S1” and “S2” to ASCII code and stores it in “D.” Example: H1234 → H 32 31 34 33 2 1 4 3	7
F74 **P74**	**ASCII code → 4-digit BCD data**	**ABCD** **PABCD**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to four digits of BCD data and stores it in “D.” Example: H 34 33 32 31 → H3412 4 3 2 1	9
F75 **P75**	**16-bit binary data → ASCII code**	**BINA** **PBINA**	S1, S2, D	Converts the 16 bits of binary data specified by “S1” to ASCII code and stores it in “D” (area of “S2” bytes). Example: K-100 → H 30 30 31 2D 20 20 0 0 1 -	7
F76 **P76**	**ASCII code → 16-bit binary data**	**ABIN** **PABIN**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to 16 bits of binary data and stores it in “D.” Example: H 30 30 31 2D 20 20 → K-100 0 0 1 -	7
F77 **P77**	**32-bit binary data → ASCII code**	**DBIA** **PDBIA**	S1, S2, D	Converts the 32 bits of binary data (S1+1, S1) to ASCII code and stores it in (D+1, D).	11

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	C24 C40	C56 C72	FP-M(*1) C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Data conversion instructions												
F70 P70	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F71 P71	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F72 P72	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F73 P73	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F74 P74	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F75 P75	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F76 P76	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F77 P77	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Number	Name	Boolean	Operand	Description	Steps
F78 **P78**	**ASCII code → 32-bit binary data**	**DABI** **PDABI**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to 32 bits of binary data and stores it in (D+1, D).	11
F80 **P80**	**16-bit binary data → 4-digit BCD data**	**BCD** **PBCD**	S, D	Converts the 16 bits of binary data specified by “S” to four digits of BCD data and stores it in “D.” Example: K100 → H100	5
F81 **P81**	**4-digit BCD data → 16-bit binary data**	**BIN** **PBIN**	S, D	Converts the four digits of BCD data specified by “S” to 16 bits of binary data and stores it in “D.” Example: H100 → K100	5
F82 **P82**	**32-bit binary data → 8-digit BCD data**	**DBCD** **PDBCD**	S, D	Converts the 32 bits of binary data specified by (S+1, S) to eight digits of BCD data and stores it in (D+1, D).	7
F83 **P83**	**8-digit BCD data → 32-bit binary data**	**DBIN** **PDBIN**	S, D	Converts the eight digits of BCD data specified by (S+1, S) to 32 bits of binary data and stores it in (D+1, D).	7
F84 **P84**	**16-bit data invert (complement of 1)**	**INV** **PINV**	D	Inverts each bit of data of “D.”	3
F85 **P85**	**16-bit data complement of 2**	**NEG** **PNEG**	D	Inverts each bit of data of “D” and adds 1 (inverts the sign).	3
F86 **P86**	**32-bit data complement of 2**	**DNEG** **PDNEG**	D	Inverts each bit of data of (D+1, D) and adds 1 (inverts the sign).	3
F87 **P87**	**16-bit data absolute**	**ABS** **PABS**	D	Gives the absolute value of the data of “D.”	3

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	C24 C40	C56 C72	FP-M(*1) C16	C20 C32	FP3	FP2	FP2SH	FP10SH
F78 P78	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F80 P80	A	A	A	A	A	A	A	A	A	A	A	A
F81 P81	A	A	A	A	A	A	A	A	A	A	A	A
F82 P82	A	A	A	A	A	A	A	A	A	A	A	A
F83 P83	A	A	A	A	A	A	A	A	A	A	A	A
F84 P84	A	A	A	A	A	A	A	A	A	A	A	A
F85 P85	A	A	A	A	A	A	A	A	A	A	A	A
F86 P86	A	A	A	A	A	A	A	A	A	A	A	A
F87 P87	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Number	Name	Boolean	Operand	Description	Steps
F88 **P88**	**32-bit data absolute**	**DABS** **PDABS**	D	Gives the absolute value of the data of (D+1, D).	3
F89 **P89**	**16-bit data sign extension**	**EXT** **PEXT**	D	Extends the 16 bits of data in “D” to 32 bits in (D+1, D).	3
F90 **P90**	**Decode**	**DECO** **PDECO**	S, n, D	Decodes part of the data of “S” and stores it in “D.” The part is specified by “n.”	7
F91 **P91**	**7-segment decode**	**SEGT** **PSEGT**	S, D	Converts the data of “S” for use in a 7-segment display and stores it in (D+1, D).	5
F92 **P92**	**Encode**	**ENCO** **PENCO**	S, n, D	Encodes part of the data of “S” and stores it in “D.” The part is specified by “n.”	7
F93 **P93**	**16-bit data combine**	**UNIT** **PUNIT**	S, n, D	The least significant digit of each of the “n” words of data beginning at “S” are stored (united) in order in “D.”	7
F94 **P94**	**16-bit data distribute**	**DIST** **PDIST**	S, n, D	Each of the digits of the data of “S” are stored in (distributed to) the least significant digits of the areas beginning at “D.”	7
F95 **P95**	**Character → ASCII code**	**ASC** **PASC**	S, D	Twelve characters of the character constants of “S” are converted to ASCII code and stored in “D” to “D+5.”	15
F96 **P96**	**16-bit table data search**	**SRC** **PSRC**	S1, S2, S3	The data of “S1” is searched for in the areas in the range “S2” to “S3” and the result is stored in DT9037 and DT9038 for FP0/FP-e/FP1/FP-M/FP3 and DT90037 and DT90038 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH.	7
F97 **P97**	**32-bit table data search**	**DSRC** **PDSRC**	S1, S2, S3	The data of (S1+1, S1) is searched for in the 32-bit data designated by “S3”, beginning from “S2”, and the result is stored in DT90037 and DT90038.	11
Data shift instructions					
F98 **P98**	**Data table shift-out and compress**	**CMPR** **PCMPR**	D1, D2, D3	Transfer “D2” to “D3.” Any parts of the data between “D1” and “D2” that are 0 are compressed, and shifted in order toward “D2.”	7

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	FP1 (* 1) C24 C40	FP1 (* 1) C56 C72	FP-M(*1) C16	FP-M(*1) C20 C32	FP3	FP2	FP2SH	FP10SH
F88 P88	A	A	A	A	A	A	A	A	A	A	A	A
F89 P89	A	A	A	A	A	A	A	A	A	A	A	A
F90 P90	A	A	A	A	A	A	A	A	A	A	A	A
F91 P91	A	A	A	A	A	A	A	A	A	A	A	A
F92 P92	A	A	A	A	A	A	A	A	A	A	A	A
F93 P93	A	A	A	A	A	A	A	A	A	A	A	A
F94 P94	A	A	A	A	A	A	A	A	A	A	A	A
F95 P95	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F96 P96	A	A	A	A	A	A	A	A	A	A	A	A
F97 P97	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data shift instructions												
F98 P98	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Num-ber	Name	Boolean	Operand	Description	Steps
F99 **P99**	**Data table shift-in and compress**	**CMPW** **PCMPW**	S, D1, D2	Transfer “S” to “D1”. Any parts of the data between “D1” and “D2” that are 0 are compressed, and shifted in order toward “D2.”	7
F100 **P100**	**Right shift of multiple bits (n bits) in a 16-bit data**	**SHR** **PSHR**	D, n	Shifts the “n” bits of “D” to the right.	5
F101 **P101**	**Left shift of multiple bits (n bits) in a 16-bit data**	**SHL** **PSHL**	D, n	Shifts the “n” bits of “D” to the left.	5
F102 **P102**	**Right shift of n bits in a 32-bit data**	**DSHR** **PDSHR**	D, n	Shifts the “n” bits of the 32-bit data area specified by (D+1, D) to the right.	5
F103 **P103**	**Left shift of n bits in a 32-bit data**	**DSHL** **PDSHL**	D, n	Shifts the “n” bits of the 32-bit data area specified by (D+1, D) to the left.	5
F105 **P105**	**Right shift of one hexa-decimal digit (4-bit)**	**BSR** **PBSR**	D	Shifts the one digit of data of “D” to the right.	3
F106 **P106**	**Left shift of one hexade-cimal digit (4-bit)**	**BSL** **PBSL**	D	Shifts the one digit of data of “D” to the left.	3
F108 **P108**	**Right shift of multiple bits (n bits)**	**BITR** **PBITR**	D1, D2, n	Shifts the “n” bits of data range by “D1” and “D2” to the right.	7
F109 **P109**	**Left shift of multiple bits (n bits)**	**BITL** **PBITL**	D1, D2, n	Shifts the “n” bits of data range by “D1” and “D2” to the left.	7
F110 **P110**	**Right shift of one word (16-bit)**	**WSHR** **PWSHR**	D1, D2	Shifts the one word of the areas by “D1” and “D2” to the right.	5
F111 **P111**	**Left shift of one word (16-bit)**	**WSHL** **PWSHL**	D1, D2	Shifts the one word of the areas by “D1” and “D2” to the left.	5
F112 **P112**	**Right shift of one hexa-decimal digit (4-bit)**	**WBSR** **PWBSR**	D1, D2	Shifts the one digit of the areas by “D1” and “D2” to the right.	5

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	FP1 (* 1) C24 C40	FP1 (* 1) C56 C72	FP-M(*1) C16	FP-M(*1) C20 C32	FP3	FP2	FP2SH	FP10SH
F99 P99	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F100 P100	A	A	A	A	A	A	A	A	A	A	A	A
F101 P101	A	A	A	A	A	A	A	A	A	A	A	A
F102 P102	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F103 P103	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F105 P105	A	A	A	A	A	A	A	A	A	A	A	A
F106 P106	A	A	A	A	A	A	A	A	A	A	A	A
F108 P108	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F109 P109	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F110 P110	A	A	A	A	A	A	A	A	A	A	A	A
F111 P111	A	A	A	A	A	A	A	A	A	A	A	A
F112 P112	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Num-ber	Name	Boolean	Operand	Description	Steps
F113 **P113**	**Left shift of one hexade-cimal digit (4-bit)**	**WBSL** **PWBSL**	D1, D2	Shifts the one digit of the areas by “D1” and “D2” to the left.	5
FIFO instructions					
F115 **P115**	**FIFO buffer define**	**FIFT** **PFIFT**	n, D	The “n” words beginning from “D” are defined in the buffer.	5
F116 **P116**	**Data read from FIFO buffer**	**FIFR** **PFIFR**	S, D	The oldest data beginning from “S” that was written to the buffer is read and stored in “D.”	5
F117 **P117**	**Data write into FIFO buffer**	**FIFW** **PFIFW**	S, D	The data of “S” is written to the buffer starting from “D.”	5
Basic function instructions					
F118	**UP/DOWN counter**	**UDC**	S, D	Counts up or down from the value preset in “S” and stores the elapsed value in “D.”	5
F119	**Left/right shift register**	**LRSR**	D1, D2	Shifts one bit to the left or right with the area between “D1” and “D2” as the register.	5
Data rotate instructions					
F120 **P120**	**16-bit data right rotate**	**ROR** **PROR**	D, n	Rotate the “n” bits in data of “D” to the right.	5
F121 **P121**	**16-bit data left rotate**	**ROL** **PROL**	D, n	Rotate the “n” bits in data of “D” to the left.	5
F122 **P122**	**16-bit data right rotate with carry flag (R9009) data**	**RCR** **PRCR**	D, n	Rotate the “n” bits in 17-bit area consisting of “D” plus the carry flag (R9009) data to the right.	5
F123 **P123**	**16-bit data left rotate with carry flag (R9009) data**	**RCL** **PRCL**	D, n	Rotate the “n” bits in 17-bit area consisting of “D” plus the carry flag (R9009) data to the left.	5

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F113 P113	A	A	A	A	A	A	A	A	A	A	A	A
FIFO instructions												
F115 P115	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F116 P116	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F117 P117	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
Basic function instructions												
F118	A	A	A	A	A	A	A	A	A	A	A	A
F119	A	A	A	A	A	A	A	A	A	A	A	A
Data rotate instructions												
F120 P120	A	A	A	A	A	A	A	A	A	A	A	A
F121 P121	A	A	A	A	A	A	A	A	A	A	A	A
F122 P122	A	A	A	A	A	A	A	A	A	A	A	A
F123 P123	A	A	A	A	A	A	A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Num-ber	Name	Boolean	Operand	Description	Steps
F125 **P125**	**32-bit data right rotate**	**DROR** **PDROR**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the right.	5
F126 **P126**	**32-bit data left rotate**	**DROL** **PDROL**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the left.	5
F127 **P127**	**32-bit data right rotate with carry flag (R9009) data**	**DRCR** **PDRCR**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the right together with carry flag (R9009) data.	5
F128 **P128**	**32-bit data left rotate with carry flag (R9009) data**	**DRCL** **PDRCL**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the left together with carry flag (R9009) data.	5
Bit manipulation instructions					
F130 **P130**	**16-bit data bit set**	**BTS** **PBTS**	D, n	Set the value of bit position “n” of the data of “D” to 1.	5
F131 **P131**	**16-bit data bit reset**	**BTR** **PBTR**	D, n	Set the value of bit position “n” of the data of “D” to 0.	5
F132 **P132**	**16-bit data bit invert**	**BTI** **PBTI**	D, n	Invert the value of bit position “n” of the data of “D.”	5
F133 **P133**	**16-bit data bit test**	**BTT** **PBTT**	D, n	Test the value of bit position “n” of the data of “D” and output the result to R900B.	5
F135 **P135**	**Number of on (1) bits in 16-bit data**	**BCU** **PBCU**	S, D	Store the number of on bits in the data of “S” in “D.”	5
F136 **P136**	**Number of on (1) bits in 32-bit data**	**DBCU** **PDBCU**	S, D	Store the number of on bits in the data of (S+1, S) in “D.”	7

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F125 P125	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F126 P126	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F127 P127	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F128 P128	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Bit manipulation instructions												
F130 P130	A	A	A	A	A	A	A	A	A	A	A	A
F131 P131	A	A	A	A	A	A	A	A	A	A	A	A
F132 P132	A	A	A	A	A	A	A	A	A	A	A	A
F133 P133	A	A	A	A	A	A	A	A	A	A	A	A
F135 P135	A	A	A	A	A	A	A	A	A	A	A	A
F136 P136	A	A	A	A	A	A	A	A	A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
Basic function instruction					
F137	**Auxiliary timer (16-bit)**	**STMR**	S, D	Turn on the specified output and R900D after 0.01 s × set value.	5
Special instructions					
F138 **P138**	**Hours, minutes and seconds data to seconds data**	**HMSS** **PHMSS**	S, D	Converts the hour, minute and second data of (S+1, S) to seconds data, and the converted data is stored in (D+1, D).	5
F139 **P139**	**Seconds data to hours, minutes and seconds data**	**SHMS** **PSHMS**	S, D	Converts the seconds data of (S+1, S) to hour, minute and second data, and the converted data is stored in (D+1, D).	5
F140 **P140**	**Carry flag (R9009) set**	**STC** **PSTC**	—	Turns on the carry flag (R9009).	1
F141 **P141**	**Carry flag (R9009) reset**	**CLC** **PCLC**	—	Turns off the carry flag (R9009).	1

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Basic function instruction												
F137	A	A	A	N/A	N/A	A	N/A	A	A	A	A	A
Special instructions												
F138 P138	A (* 2)	A	A	N/A	A	A	N/A	A	A	A	A	A
F139 P139	A (* 2)	A	A	N/A	A	A	N/A	A	A	A	A	A
F140 P140	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F141 P141	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.**
2) **On the FP0 it is only possible to use F138 and F139 with the T32 type.**

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
F142 **P142**	**Watching dog timer update**	**WDT** **PWDT**	S	The time (allowable scan time for the system) of watching dog timer is changed to "S" × 0.1 (ms) for that scan.	3
F143 **P143**	**Partial I/O update**	**IORF** **PIORF**	D1, D2	Updates the I/O from the number specified by "D1" to the number specified by "D2."	5
F144	**Serial data communication control**	**TRNS**	S, n	The COM port receive flag (R9038) is set to off to enable reception. Beginning at "S", "n" bytes of the data registers are sent from the COM port.	5
F145 **P145**	**Data send**	**SEND** **PSEND**	S1, S2, D, N	Sends the data to another station in the network (MEWNET).	9
F146 **P146**	**Data receive**	**RECV** **PRECV**	S1, S2, N, D	Receives the data to another station in the network (MEWNET).	9
F147	**Printout**	**PR**	S, D	Converts the ASCII code data in the area starting with "S" for printing, and outputs it to the word external output relay WY specified by "D."	5
F148 **P148**	**Self-diagnostic error set**	**ERR** **PERR**	n (n: K100 to K299)	Stores the self-diagnostic error number "n" in (DT9000 for FP0/FP-e/FP1/FP-M/FP3 or DT90000 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH), turns R9000 on, and turns on the ERROR LED.	3

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1)			FP-M(*1)		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
F142 P142	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F143 P143	A	A	A	N/A	A	A	A	A	A	A	A	A
F144	A	N/A	A	N/A	A (* 2)	A (* 2)	N/A	A (* 2)	N/A	A	A	A
F145 P145	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F146 P146	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F147	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F148 P148	A	A	A	N/A	A	A	N/A	A	A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.

2) Available for: - FP1 C24C, C40C, C56C, and C72C
- FP-M C20RC, C20TC, C32TC

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
F149 **P149**	**Message display**	**MSG** **PMSG**	S	Displays the character constant of “S” in the connected programming tool.	13
F150 **P150**	**Data read from intelligent unit**	**READ** **PREAD**	S1, S2, n, D	Reads the data from the intelligent unit.	9
F151 **P151**	**Data write into intelligent unit**	**WRT** **PWRT**	S1, S2, n, D	Writes the data into the intelligent unit.	9
F152 **P152**	**Data read from MEWNET-F slave station**	**RMRD** **PRMRD**	S1, S2, n, D	Reads the data from the intelligent unit at the MEWNET-F (remote I/O) slave station.	9
F153 **P153**	**Data write into MEWNET-F slave station**	**RMWT** **PRMWT**	S1, S2, n, D	Writes the data into the intelligent unit at the MEWNET-F (remote I/O) slave station.	9
F154 **P154**	**Machine language program call**	**MCAL** **PMCAL**	n	The machine language program is called.	3
F155 **P155**	**Sampling**	**SMPL** **PSMPL**	——	Starts sampling data.	1
F156 **P156**	**Sampling trigger**	**STRG** **PSTRG**	——	When the trigger of this instruction turns on, the sampling trace stops.	1
F157 **P157**	**Time addition**	**CADD** **PCADD**	S1, S2, D	The time after (S2+1, S2) elapses from the time of (S1+2, S1+1, S1) is stored in (D+2, D+1, D).	9
F158 **P158**	**Time substruction**	**CSUB** **PCSUB**	S1, S2, D	The time that results from subtracting (S2+1, S2) from the time (S1+2, S1+1, S1) is stored in (D+2, D+1, D).	9
F159	**Serial data communication**	**MTRN**	S, n, D	This is used to send data to or receive data from an external device through the specified COM., RS232C or RS485 port.	7
BIN arithmetic instruction					
F160 **P160**	**Double word (32-bit) data square root**	**DSQR** **PDSQR**	S, D	$\sqrt{(S)} \rightarrow (D)$	7

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 (* 1) C14 C16	C24 C40	C56 C72	FP-M(*1) C16	C20 C32	FP3	FP2	FP2SH	FP10SH
F149 P149	A	A (* 2)	A	N/A	A	A	N/A	A	A	A	A	A
F150 P150	N/A	A (* 2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F151 P151	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F152 P152	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	A	A	A	A
F153 P153	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F154 P154	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A	N/A
F155 P155	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F156 P156	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F157 P157	A (* 3)	A	A	N/A	A	A	A	A	A	A	A	A
F158 P158	A (* 3)	A	A	N/A	A	A	A	A	A	A	A	A
F159	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIN arithmetic instruction												
F160 P160	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0/FPΣ/FP-e/FP1/FP-M, the P type high-level instructions are not available.**
2) **The instruction is available for FPΣ CPU Ver. 2.0 or later.**
3) **On the FP0 it is only possible to use F157 and F158 with the T32 type.**

Number	Name	Boolean	Operand	Description	Steps
Special instructions (High-speed counter instructions)					
F0	**High-speed counter and Pulse output controls**	**MV**	S, DT9052	Performs high-speed counter and Pulse output controls according to the control code specified by “S”. The control code is stored in DT9052.	5
F1	**Change and read of the elapsed value of high-speed counter and Pulse output**	**DMV**	S, DT9044	Transfers (S+1, S) to high-speed counter and Pulse output elapsed value area (DT9045, DT9044).	7
			DT9044, D	Transfers value in high-speed counter and Pulse output elapsed value area (DT9045, DT9044) to (D+1, D).	7
F162	**High-speed counter output set**	**HC0S**	S, Yn	The specified external output relay (Yn) turns on when the elapsed value of the high-speed counter agrees with the specified target value (S+1, S).	7
F163	**High-speed counter output reset**	**HC0R**	S, Yn	The specified external output relay (Yn) turns off when the elapsed value of the high-speed counter agrees with the specified target value (S+1, S).	7
F164	**Speed control (Pulse output and pattern output controls) (See below.)**	**SPD0**	S	Controls conditions of outputs according to the elapsed value of the high-speed counter. Two types of output control available: - Pulse output control - Pattern output control	3
F165	**Cam control**	**CAM0**	S	Controls cam operation (on/off patterns of each cam output) according to the elapsed value of the high-speed counter.	3

Pulse output specifications for FP-M/FP1

Item	FP1 C14/C16, FP-M C16T	FP1 C24/C40	FP1 C56/C72 FP-M C20T/C20R/C32T
Pulse output terminal	Y7	Y7	Y6 and Y7 (selectable)
Pulse frequency	1440Hz to 5kHz/720Hz to 5kHz/360Hz to 5kHz/180Hz to 5kHz/ 90Hz to 5kHz/45Hz to 5kHz (Switches between 6 ranges)		
Internal connection between pulse output and counter input	Not possible	Not possible	Possible

Switching of the pulse frequency range is supported by CPU Ver. 2.7 or later.

In versions prior to CPU Ver. 2.7, the range is fixed at 360Hz to 5kHz.

In Ver. 2.7 or later but prior to CPU Ver. 2.9, switching is possible among 4 ranges (360Hz to 5kHz/180Hz to 5kHz/90Hz to 5kHz/45Hz to 5kHz).

In CPU Ver. 2.9 and later versions, switching is possible among 6 ranges.

Number	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
High-speed counter instructions for FP1, FP-M												
F0	A	N/A	A	A	A	A	A	A	N/A	N/A	N/A	N/A
F1	A (* 1)	N/A	A	A	A	A	A	A	N/A	N/A	N/A	N/A
F162	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F163	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F164	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F165	N/A	N/A	N/A	A	A	A	N/A	A	N/A	N/A	N/A	N/A

Notes

- **A: Available, N/A: Not available**

1) The elapsed value area varies depending on the channel being used.

Number	Name	Boolean	Operand	Description	Steps
High speed counter / Pulse output instruction for FP0					
F166	**High-speed counter output set (with channel specification)**	**HC1S**	n, S, Yn	Turns output Yn on when the elapsed value of the built-in high-speed counter reaches the target value of (S+1,S).	11
F167	**High-speed counter output reset (with channel specification)**	**HC1R**	n, S, Yn	Turns output Yn off when the elapsed value of the built-in high-speed counter reaches the target value of (S+1,S).	11
F168	**Positioning control (with channel specification)**	**SPD1**	S, n	Outputs a positioning pulse from the specified output (Y0 or Y1) according to the contents of the data table beginning at “S”.	5
F169	**Pulse output (with channel specification)**	**PLS**	S, n	Outputs a pulse from the specified output (Y0 or Y1) according to the contents of the data table beginning at “S”.	5
F170	**PWM output (with channel specification)**	**PWM**	S, n	Performs PWM output from the specified output (Y0 or Y1) according to the contents of the data table beginning at “S”.	5

Number	Availability											
	FP0	FPΣ	FP-e	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
High speed counter / Pulse output instruction for FP0												
F166	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F167	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F168	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F169	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F170	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note

A: Available, N/A: Not available

The elapsed value area varies depending on the channel being used.

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
High speed counter / Pulse output instruction for FPΣ					
F0	**High-speed counter and Pulse output controls**	**MV**	S, DT90052	Performs high-speed counter and Pulse output controls according to the control code specified by "S". The control code is stored in DT90052.	5
F1	**Change and read of the elapsed value of high-speed counter and Pulse output**	**DMV**	S, DT90044	Transfers (S+1, S) to high-speed counter and Pulse output elapsed value area (DT90045, DT90044).	7
			DT90044, D	Transfers value in high-speed counter and Pulse output elapsed value area (DT90045, DT90044) to (D+1, D).	7
F166	**Target value much on (with channel specification)**	**HC1S**	n, S, D	Turns output Yn on when the elapsed value of the built-in high-speed counter reaches the target value of (S+1,S).	11
F167	**Target value much off (with channel specification)**	**HC1R**	n, S, D	Turns output Yn off when the elapsed value of the built-in high-speed counter reaches the target value of (S+1,S).	11
F171	**Pulse output (with channel specification) (Trapezoidal control and home return)**	**SPDH**	S, n	Positioning pulses are output from the specified channel, in accordance with the contents of the data table that starts with S.	5
F172	**Pulse output (with channel specification) (JOG operation)**	**PLSH**	S, n	Pulse strings are output from the specified output, in accordance with the contents of the data table that starts with S.	5
F173	**PWM output (with channel specification)**	**PWMH**	S, n	PWM output is output from the specified output, in accordance with the contents of the data table that starts with S.	5
F174	**Pulse output (with channel specification) (Selectable data table control operation)**	**SP0H**	S, n	Outputs the pulses from the specified channel according to the data table specified by S.	5
F175	**Pulse output (Linear interpolation)**	**SPSH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms a straight line.	5
F176	**Pulse output (Circular interpolation)**	**SPCH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms an arc.	5

Number	Availability											
				FP1			FP-M					
	FP0	FPΣ	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
High speed counter / Pulse output instruction for FPΣ												
F0	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F1	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F166	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F167	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F171	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F172	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F173	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F174	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F175	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F176	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

12.8 Table of Instructions

Num-ber	Name	Boolean	Operand	Description	Steps
Screen display instructions					
F180	**FP-e screen display registration**	**SCR**	S1, S2, S3, S4	Register the screen displayed on the FP-e.	9
F181	**FP-e screen display switching**	**DSP**	S	Specify the screen to be displayed on the FP-e.	3
Basic function instruction					
F183	**Auxiliary timer (32-bit)**	**DSTM**	S, D	Turn on the specified output and R900D after 0.01 s. × set value.	7
Data transfer instructions					
F190 **P190**	**Three 16-bit data move**	**MV3** **PMV3**	S1, S2, S3, D	(S1) → (D), (S2) → (D+1), (S3) → (D+2)	10
F191 **P191**	**Three 32-bit data move**	**DMV3** **PDMV3**	S1, S2, S3, D	(S1+1, S1) → (D+1, D), (S2+1, S2) → (D+3, D+2), (S3+1, S3) → (D+5, D+4)	16
Logic operation instructions					
F215 **P215**	**32-bit data AND**	**DAND** **PDAND**	S1, S2, D	(S1+1, S1) AND (S2+1, S2) → (D+1, D)	12
F216 **P216**	**32-bit data OR**	**DOR** **PDOR**	S1, S2, D	(S1+1, S1) OR (S2+1, S2) → (D+1, D)	12
F217 **P217**	**32-bit data XOR**	**DXOR** **PDXOR**	S1, S2, D	{(S1+1, S1) AND $\overline{\text{(S2+1, S2)}}$} OR {$\overline{\text{(S1+1, S1)}}$ AND (S2+1, S2)} → (D+1, D)	12
F218 **P218**	**32-bit data XNR**	**DXNR** **PDXNR**	S1, S2, D	{(S1+1, S1) AND (S2+1, S2)} OR {$\overline{\text{(S1+1, S1)}}$ AND $\overline{\text{(S2+1, S2)}}$} → (D+1, D)	12
F219 **P219**	**Double word (32-bit) data unites**	**DUNI** **PDUNI**	S1, S2, S3, D	{(S1+1, S1) AND (S3+1, S3)} OR {(S2+1, S2) AND $\overline{\text{(S3+1, S3)}}$} → (D+1, D)	16
Data conversion instructions					
F235 **P235**	**16-bit binary data → Gray code conversion**	**GRY** **PGRY**	S, D	Converts the 16-bit binary data of “S” to gray codes, and the converted result is stored in the “D.”	6
F236 **P236**	**32-bit binary data → Gray code conversion**	**DGRY** **PDGRY**	S, D	Converts the 32-bit binary data of (S+1, S) to gray code, and the converted result is stored in the (D+1, D).	8

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Screen display instructions												
F180	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F181	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Basic function instruction												
F183	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data transfer instructions												
F190 P190	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F191 P191	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Logic operation instructions												
F215 P215	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F216 P216	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F217 P217	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F218 P218	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F219 P219	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data conversion instructions												
F235 P235	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F236 P236	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
F237 **P237**	**16-bit gray code → binary data conversion**	**GBIN** **PGBIN**	S, D	Converts the gray codes of “S” to binary data, and the converted result is stored in the “D.”	6
F238 **P238**	**32-bit gray code → binary data conversion**	**DGBIN** **PDGBIN**	S, D	Converts the gray code of (S+1, S) to binary data,and the converted result is stored in the (D+1, D).	8
F240 **P240**	**Bit line to bit column conversion**	**COLM** **PCOLM**	S, n, D	The values of bits 0 to 15 of “S” are stored in bit “n” of (D to D+15).	8
F241 **P241**	**Bit column to bit line conversion**	**LINE** **PLINE**	S, n, D	The values of bit “n” of (S to S+15) are stored in bits 0 to 15 of “D.”	8
Character strings instructions					
F257 **P257**	**Comparing character strings**	**SCMP**	S1, S2	These instructions compare two specified character strings and output the judgment results to a special internal relay.	10
F258 **P258**	**Character string coupling**	**SADD**	S1, S2, D	These instructions couple one character string with another.	12
F259 **P259**	**Number of characters in a character string**	**LEN**	S, D	These instructions determine the number of characters in a character string.	6
F260 **P260**	**Search for character string**	**SSRC**	S1, S2, D	The specified character is searched in a character string.	10
F261 **P261**	**Retrieving data from character strings (right side)**	**RIGHT**	S1, S2, D	These instructions retrieve a specified number of characters from the right side of the character string.	8
F262 **P262**	**Retrieving data from character strings (left side)**	**LEFT**	S1, S2, D	These instructions retrieve a specified number of characters from the left side of the character string.	8
F263 **P263**	**Retrieving a character string from a character string**	**MIDR**	S1, S2, S3, D	These instructions retrieve a character string consisting of a specified number of characters from the specified position in the character string.	10

Number	Availability											
	FP0	FPΣ (* 1)	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F237 P237	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F238 P238	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F240 P240	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F241 P241	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Character strings instructions												
F257 P257	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F258 P258	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F259 P259	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F260 P260	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F261 P261	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F262 P262	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F263 P263	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FPΣ, the P type high-level instructions are not available.

12.8 Table of Instructions

Number	Name	Boolean	Operand	Description	Steps
F264 **P264**	**Writing a character string to a character string**	**MIDW**	S1, S2, D, n	These instructions write a specified number of characters from a character string to a specified position in the character string.	12
F265 **P265**	**Replacing character strings**	**SREP**	S, D, p, n	A specified number of characters in a character string are rewritten, starting from a specified position in the character string.	12
Integer type data processing instructions					
F270 **P270**	**Maximum value (word data (16-bit))**	**MAX** **PMAX**	S1, S2, D	Searches the maximum value in the word data table between the “S1” and “S2”, and stores it in the “D.” The address relative to “S1” is stored in “D+1.”	8
F271 **P271**	**Maximum value (double word data (32-bit))**	**DMAX** **PDMAX**	S1, S2, D	Searches for the maximum value in the double word data table between the area selected with “S1” and “S2”, and stores it in the “D.” The address relative to “S1” is stored in “D+2.”	8
F272 **P272**	**Minimum value (word data (16-bit))**	**MIN** **PMIN**	S1, S2, D	Searches for the minimum value in the word data table between the area selected with “S1” and “S2”, and stores it in the “D.” The address relative to “S1” is stored in “D+1.”	8
F273 **P273**	**Minimum value (double word data (32-bit))**	**DMIN** **PDMIN**	S1, S2, D	Searches for the minimum value in the double word data table between the area selected with “S1” and “S2”, and stores it in the “D”. The address relative to “S1” is stored in “D+2.”	8
F275 **P275**	**Total and mean values (word data (16-bit))**	**MEAN** **PMEAN**	S1, S2, D	The total value and the mean value of the word data with sign from the area selected with “S1” to the “S2” are obtained and stored in the “D.”	8
F276 **P276**	**Total and mean values (double word data (32-bit))**	**DMEAN** **PDMEAN**	S1, S2, D	The total value and the mean value of the double word data with sign from the area selected with “S1” to “S2” are obtained and stored in the “D.”	8
F277 **P277**	**Sort (word data (16-bit))**	**SORT** **PSORT**	S1, S2, S3	The word data with sign from the area specified by “S1” to “S2” are sorted in ascending order (the smallest word is first) or descending order (the largest word is first).	8
F278 **P278**	**Sort (double word data (32-bit))**	**DSORT** **PDSORT**	S1, S2, S3	The double word data with sign from the area specified by “S1” to “S2” are sorted in ascending order (the smallest word is first) or descending order (the largest word is first).	8

Number	Availability											
	FP0	FPΣ (* 1)	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F264 P264	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F265 P265	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Integer type data processing instructions												
F270 P270	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F271 P271	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F272 P272	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F273 P273	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F275 P275	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F276 P276	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F277 P277	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F278 P278	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FPΣ, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
F282 **P282**	**Scaling of 16-bit data**	**SCAL** **PSCAL**	S1, S2, D	The output value Y is found for the input value X by performing scaling for the given data table.	8
F283 **P283**	**Scaling of 32-bit data**	**DSCAL** **PDSCAL**	S1, S2, D	The output value Y is found for the input value X by performing scaling for the given data table.	10
Integer type non-linear function instructions					
F285 **P285**	**Upper and lower limit control (16-bit data)**	**LIMT** **PLIMT**	S1, S2, S3, D	When S1 > S3, S1 → D When S2 < S3, S2 → D When S1 < or = S3 < or = S2, S3 → D	10
F286 **P286**	**Upper and lower limit control (32-bit data)**	**DLIMT** **PDLIMT**	S1, S2, S3, D	When (S1+1, S1) > (S3+1, S3), (S1+1, S1) → (D+1, D) When (S2+1, S2) < (S3+1, S3), (S2+1, S2) → (D+1, D) When (S1+1, S1) < or = (S3+1, S3) < or = (S2+1, S2), (S3+1, S3) → (D+1, D)	16
F287 **P287**	**Deadband control (16-bit data)**	**BAND** **PBAND**	S1, S2, S3, D	When S1 > S3, S3 - S1 → D When S2 < S3, S3 - S2 → D When S1 < or = S3 < or = S2, 0 → D	10
F288 **P288**	**Deadband control (32-bit data)**	**DBAND** **PDBAND**	S1, S2, S3, D	When (S1+1, S1) > (S3+1, S3), (S3+1, S3) - (S1+1, S1) → (D+1, D) When (S2+1, S2) < (S3+1, S3), (S3+1, S3) - (S2+1, S2) → (D+1, D) When (S1+1, S1) < or = (S3+1, S3) < or = (S2+1, S2), 0 → (D+1, D)	16
F289 **P289**	**Zone control (16-bit data)**	**ZONE** **PZONE**	S1, S2, S3, D	When S3 < 0, S3 + S1 → D When S3 = 0, 0 → D When S3 > 0, S3 + S2 → D	10
F290 **P290**	**Zone control (32-bit data)**	**DZONE** **PDZONE**	S1, S2, S3, D	When (S3+1, S3) < 0, (S3+1, S3) + (S1+1, S1) → (D+1, D) When (S3+1, S3) = 0, 0 → (D+1, D) When (S3+1, S3) > 0, (S3+1, S3) + (S2+1, S2) → (D+1, D)	16

Number	Availability											
	FP0	FPΣ (* 1)	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F282 P282	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F283 P283	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Integer type non-linear function instructions												
F285 P285	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F286 P286	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F287 P287	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F288 P288	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F289 P289	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F290 P290	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FPΣ, the P type high-level instructions are not available.

Number	Name	Boolean	Operand	Description	Steps
BCD type real number operation instructions					
F300 **P300**	**BCD type sine operation**	**BSIN** **PBSIN**	S, D	SIN (S+1, S) → (D+1, D)	6
F301 **P301**	**BCD type cosine operation**	**BCOS** **PBCOS**	S, D	COS (S+1, S) → (D+1, D)	6
F302 **P302**	**BCD type tangent operation**	**BTAN** **PBTAN**	S, D	TAN (S+1, S) → (D+1, D)	6
F303 **P303**	**BCD type arcsine operation**	**BASIN** **PBASIN**	S, D	SIN^{-1} (S+1, S) → (D+1, D)	6
F304 **P304**	**BCD type arccosine operation**	**BACOS** **PBACOS**	S, D	COS^{-1} (S+1, S) → (D+1, D)	6
F305 **P305**	**BCD type arctangent operation**	**BATAN** **PBATAN**	S, D	TAN^{-1} (S+1, S) → (D+1, D)	6

Number	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
BCD type real number operation instructions												
F300 P300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F301 P301	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F302 P302	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F303 P303	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F304 P304	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F305 P305	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

☞ **Note**

A: Available, N/A: Not available

Num-ber	Name	Boolean	Operand	Description	Steps
Floating-point type real number operation instructions					
F309 **P309**	**Floating-point type data move**	**FMV** **PFMV**	S, D	(S+1, S) → (D+1, D)	8
F310 **P310**	**Floating-point type data addition**	**F+** **PF+**	S1, S2, D	(S1+1, S1) + (S2+1, S2) → (D+1, D)	14
F311 **P311**	**Floating-point type data subtraction**	**F-** **PF-**	S1, S2, D	(S1+1, S1) - (S2+1, S2) → (D+1, D)	14
F312 **P312**	**Floating-point type data multiplication**	**F*** **PF***	S1, S2, D	(S1+1, S1) × (S2+1, S2) → (D+1, D)	14
F313 **P313**	**Floating-point type data division**	**F%** **PF%**	S1, S2, D	(S1+1, S1) ÷ (S2+1, S2) → (D+1, D)	14
F314 **P314**	**Floating-point type data sine operation**	**SIN** **PSIN**	S, D	SIN (S+1, S) → (D+1, D)	10
F315 **P315**	**Floating-point type data cosine operation**	**COS** **PCOS**	S, D	COS (S+1, S) → (D+1, D)	10
F316 **P316**	**Floating-point type data tangent operation**	**TAN** **PTAN**	S, D	TAN (S+1, S) → (D+1, D)	10
F317 **P317**	**Floating-point type data arcsine operation**	**ASIN** **PASIN**	S, D	SIN^{-1} (S+1, S) → (D+1, D)	10
F318 **P318**	**Floating-point type data arccosine operation**	**ACOS** **PACOS**	S, D	COS^{-1} (S+1, S) → (D+1, D)	10

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1			FP-M		FP3	FP2	FP2SH	FP10SH
				C14 C16	C24 C40	C56 C72	C16	C20 C32				
Floating-point type real number operation instructions												
F309 P309	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F310 P310	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F311 P311	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F312 P312	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F313 P313	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F314 P314	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F315 P315	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F316 P316	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F317 P317	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F318 P318	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

☞ Notes

- **A: Available, N/A: Not available**

1) For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Number	Name	Boolean	Operand	Description	Steps
F319 **P319**	**Floating-point type data arctangent operation**	**ATAN** **PATAN**	S, D	TAN^{-1} (S+1, S) → (D+1, D)	10
F320 **P320**	**Floating-point type data natural logarithm**	**LN** **PLN**	S, D	LN (S+1, S) → (D+1, D)	10
F321 **P321**	**Floating-point type data exponent**	**EXP** **PEXP**	S, D	EXP (S+1, S) → (D+1, D)	10
F322 **P322**	**Floating-point type data logarithm**	**LOG** **PLOG**	S, D	LOG (S+1, S) → (D+1, D)	10
F323 **P323**	**Floating-point type data power**	**PWR** **PPWR**	S1, S2, D	(S1+1, S1) ^ (S2+1, S2) → (D+1, D)	14
F324 **P324**	**Floating-point type data square root**	**FSQR** **PFSQR**	S, D	$\sqrt{(S+1, S)}$ → (D+1, D)	10
F325 **P325**	**16-bit integer data to floating-point type data conversion**	**FLT** **PFLT**	S, D	Converts the 16-bit integer data with sign specified by “S” to real number data, and the converted data is stored in “D.”	6
F326 **P326**	**32-bit integer data to floating-point type data conversion**	**DFLT** **PDFLT**	S, D	Converts the 32-bit integer data with sign specified by (S+1, S) to real number data, and the converted data is stored in (D+1, D).	8

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F319 **P319**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F320 **P320**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F321 **P321**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F322 **P322**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F323 **P323**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F324 **P324**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F325 **P325**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F326 **P326**	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Number	Name	Boolean	Operand	Description	Steps
F327 **P327**	**Floating-point type data to 16-bit integer conversion (the largest integer not exceeding the floating-point type data)**	**INT** **PINT**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (the largest integer not exceeding the floating-point data), and the converted data is stored in "D."	8
F328 **P328**	**Floating-point type data to 32-bit integer conversion (the largest integer not exceeding the floating-point type data)**	**DINT** **PDINT**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign (the largest integer not exceeding the floating-point data), and the converted data is stored in (D+1, D).	8
F329 **P329**	**Floating-point type data to 16-bit integer conversion (rounding the first decimal point down to integer)**	**FIX** **PFIX**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (rounding the first decimal point down), and the converted data is stored in "D."	8
F330 **P330**	**Floating-point type data to 32-bit integer conversion (rounding the first decimal point down to integer)**	**DFIX** **PDFIX**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign (rounding the first decimal point down), and the converted data is stored in (D+1, D).	8

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F327 P327	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F328 P328	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F329 P329	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F330 P330	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.**
2) **The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.**

Number	Name	Boolean	Operand	Description	Steps
F331 **P331**	**Floating-point type data to 16-bit integer conversion (rounding the first decimal point off to integer)**	**ROFF** **PROFF**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (rounding the first decimal point off), and the converted data is stored in “D.”	8
F332 **P332**	**Floating-point type data to 32-bit integer conversion (rounding the first decimal point off to integer)**	**DROFF** **PDROFF**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign(rounding the first decimal point off), and the converted data is stored in (D+1, D).	8
F333 **P333**	**Floating-point type data rounding the first decimal point down**	**FINT** **PFINT**	S, D	The decimal part of the real number data specified in (S+1, S) is rounded down, and the result is stored in (D+1, D).	8
F334 **P334**	**Floating-point type data rounding the first decimal point off**	**FRINT** **PFRINT**	S, D	The decimal part of the real number data stored in (S+1, S) is rounded off, and the result is stored in (D+1, D).	8
F335 **P335**	**Floating-point type data sign changes**	**F+/-** **PF+/-**	S, D	The real number data stored in (S+1, S) is changed the sign, and the result is stored in (D+1, D).	8
F336 **P336**	**Floating-point type data absolute**	**FABS** **PFABS**	S, D	Takes the absolute value of real number data specified by (S+1, S), and the result (absolute value) is stored in (D+1, D).	8
F337 **P337**	**Floating-point type data degree → radian**	**RAD** **PRAD**	S, D	The data in degrees of an angle specified in (S+1, S) is converted to radians (real number data), and the result is stored in (D+1, D).	8

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F331 P331	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F332 P332	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F333 P333	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F334 P334	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F335 P335	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F336 P336	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F337 P337	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.**
2) **The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.**

Number	Name	Boolean	Operand	Description	Steps
F338 **P338**	**Floating-point type data radian → degree**	**DEG** **PDEG**	S, D	The angle data in radians (real number data) specified in (S+1, S) is converted to angle data in degrees, and the result is stored in (D+1, D).	8
Floating-point type real number data processing instructions					
F345 **P345**	**Floating-point type data compare**	**FCMP** **PFCMP**	S1, S2	(S1+1, S1) > (S2+1, S2) → R900A: on (S1+1, S1) = (S2+1, S2) → R900B: on (S1+1, S1) < (S2+1, S2) → R900C: on	10
F346 **P346**	**Floating-point type data band compare**	**FWIN** **PFWIN**	S1, S2, S3	(S1+1, S1) > (S3+1, S3) → R900A: on (S2+1, S2) < or = (S1+1, S1) < or = (S3+1,S3) → R900B: on (S1+1, S1) < (S2+1, S2) → R900C: on	14
F347 **P347**	**Floating-point type data upper and lower limit control**	**FLIMT** **PFLIMT**	S1, S2, S3, D	When (S1+1, S1) > (S3+1, S3), (S1+1, S1) → (D+1, D) When (S2+1, S2) < (S3+1, S3), (S2+1, S2) → (D+1, D) When (S1+1, S1) < or = (S3+1, S3) < or = (S2+1, S2), (S3+1, S3) → (D+1, D)	17
F348 **P348**	**Floating-point type data dead-band control**	**FBAND** **PFBAND**	S1, S2, S3, D	When (S1+1, S1) > (S3+1, S3), (S3+1, S3) - (S1+1, S1) → (D+1, D) When (S2+1, S2) < (S3+1, S3), (S3+1, S3) - (S2+1, S2) → (D+1, D) When (S1+1, S1) < or = (S3+1, S3) < or = (S2+1, S2), 0.0 → (D+1, D)	17
F349 **P349**	**Floating-point type data zone control**	**FZONE** **PFZONE**	S1, S2, S3, D	When (S3+1, S3) < 0.0, (S3+1, S3) + (S1+1, S1) → (D+1, D) When (S3+1, S3) = 0.0, 0.0 → (D+1, D) When (S3+1, S3) > 0.0, (S3+1, S3) + (S2+1, S2) → (D+1, D)	17
F350 **P350**	**Floating-point type data maximum value**	**FMAX** **PFMAX**	S1, S2, D	Searches the maximum value in the real number data table between the area selected with “S1” and “S2”, and stores it in the (D+1, D). The address relative to “S1” is stored in (D+2).	8

Number	Availability											
	FP0 (* 1)	FPΣ (* 1)	FP-e (* 1)	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F338 P338	A (* 2)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Floating-point type real number data processing instructions												
F345 P345	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F346 P346	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F347 P347	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F348 P348	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F349 P349	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F350 P350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) **For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.**
2) **The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.**

Num-ber	Name	Boolean	Operand	Description	Steps
F351 **P351**	**Floating-point type data minimum value**	**FMIN** **PFMIN**	S1, S2, D	Searches the minimum value in the real number data table between the area selected with “S1” and “S2”, and stores it in the (D+1, D). The address relative to “S1” is stored in (D+2).	8
F352 **P352**	**Floating-point type data total and mean values**	**FMEAN** **PFMEAN**	S1, S2, D	The total value and the mean value of the real number data from the area selected with “S1” to “S2” are obtained. The total value is stored in the (D+1, D) and the mean value is stored in the (D+3, D+2).	8
F353 **P353**	**Floating-point type data sort**	**FSORT** **PFSORT**	S1, S2, S3	The real number data from the area specified by “S1” to “S2” are sorted in ascending order (the smallest word is first) or descending order (the largest word is first).	8
Time series processing instruction					
F355	**PID processing**	**PID**	S	PID processing is performed depending on the control value (mode and parameter) specified by (S to S+2) and (S+4 to S+10), and the result is stored in the (S+3).	4
Compare instructions					
F373 **P373**	**16-bit data revision detection**	**DTR** **PDTR**	S, D	If the data in the 16-bit area specified by “S” has changed since the previous execution, internal relay R9009 (carry flag) will turn on. “D” is used to store the data of the previous execution.	6
F374 **P374**	**32-bit data revision detection**	**DDTR** **PDDTR**	S, D	If the data in the 32-bit area specified by (S+1, S) has changed since the previous execution, internal relay R9009 (carry flag) will turn on. (D+1, D) is used to store the data of the previous execution.	6

Number	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
F351 P351	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F352 P352	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F353 P353	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Time series processing instruction												
F355	A (* 1)	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Compare instructions												
F373 P373	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F374 P374	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Notes

- **A: Available, N/A: Not available**

1) For the FP0, FPΣ and FP-e, the P type high-level instructions are not available.

2) For the FP0, the instruction is available for the T32C and C10, C14, C16, C32 CPU Ver. 2.0 or later.

Number	Name	Boolean	Operand	Description	Steps
Index register bank processing instructions					
F410 **P410**	**Setting the index register bank number**	**SETB** **PSETB**	n	Index register (I0 to ID) bank number change over	4
F411 **P411**	**Changing the index register bank number**	**CHGB** **PCHGB**	n	Index register (I0 to ID) bank number change over with remembering preceding bank number.	4
F412 **P412**	**Restoring the index register bank number**	**POPB** **PPOPB**	——	Changes index register (I0 to ID) bank number back to the bank before **F411 (CHGB)**/**P411 (PCHGB)** instruction.	2
File register bank processing instructions					
F414 **P414**	**Setting the file register bank number**	**SBFL** **PSBFL**	n	File register bank number change over.	4
F415 **P415**	**Changing the file register bank number**	**CBFL** **PCBFL**	n	File register bank number change over with remembering preceding bank number.	4
F416 **P416**	**Restoring the file register bank number**	**PBFL** **PPBFL**	——	Changes file register bank number back to the bank before **F415(CBFL)/P415(PCBFL)** instruction.	2

Number	Availability											
	FP0	FPΣ	FP-e	FP1 C14 C16	FP1 C24 C40	FP1 C56 C72	FP-M C16	FP-M C20 C32	FP3	FP2	FP2SH	FP10SH
Index register bank processing instructions												
F410 P410	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F411 P411	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F412 P412	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
File register bank processing instructions												
F414 P414	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
F415 P415	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
F416 P416	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A

☞ **Note**

A: Available, N/A: Not available

12.9 FP0-SL1 S-LINK Address

I/O address input (X)	S-LINK address	
	Decimal	Hexadecimal
X80	0	0
X81	1	1
X82	2	2
X83	3	3
X84	4	4
X85	5	5
X86	6	6
X87	7	7
X88	8	8
X89	9	9
X8A	10	A
X8B	11	B
X8C	12	C
X8D	13	D
X8E	14	E
X8F	15	F

I/O address input (X)	S-LINK address	
	Decimal	Hexadecimal
X90	16	10
X91	17	11
X92	18	12
X93	19	13
X94	20	14
X95	21	15
X96	22	16
X97	23	17
X98	24	18
X99	25	19
X9A	26	1A
X9B	27	1B
X9C	28	1C
X9D	29	1D
X9E	30	1E
X9F	31	1F

I/O address input (X)	S-LINK address	
	Decimal	Hexadecimal
X100	32	20
X101	33	21
X102	34	22
X103	35	23
X104	36	24
X105	37	25
X106	38	26
X107	39	27
X108	40	28
X109	41	29
X10A	42	2A
X10B	43	2B
X10C	44	2C
X10D	45	2D
X10E	46	2E
X10F	47	2F

I/O address input (X)	S-LINK address	
	Decimal	Hexadecimal
X110	48	30
X111	49	31
X112	50	32
X113	51	33
X114	52	34
X115	53	35
X116	54	36
X117	55	37
X118	56	38
X119	57	39
X11A	58	3A
X11B	59	3B
X11C	60	3C
X11D	61	3D
X11E	62	3E
X11F	63	3F

I/O address input (Y)	S-LINK address	
	Decimal	Hexadecimal
Y80	64	40
Y81	65	41
Y82	66	42
Y83	67	43
Y84	68	44
Y85	69	45
Y86	70	46
Y87	71	47
Y88	72	48
Y89	73	49
Y8A	74	4A
Y8B	75	4B
Y8C	76	4C
Y8D	77	4D
Y8E	78	4E
Y8F	79	4F

I/O address input (Y)	S-LINK address	
	Decimal	Hexadecimal
Y90	80	50
Y91	81	51
Y92	82	52
Y93	83	53
Y94	84	54
Y95	85	55
Y96	86	56
Y97	87	57
Y98	88	58
Y99	89	59
Y9A	90	5A
Y9B	91	5B
Y9C	92	5C
Y9D	93	5D
Y9E	94	5E
Y9F	95	5F

I/O address input (Y)	S-LINK address	
	Decimal	Hexadecimal
Y100	96	60
Y101	97	61
Y102	98	62
Y103	99	63
Y104	100	64
Y105	101	65
Y106	102	66
Y107	103	67
Y108	104	68
Y109	105	69
Y10A	106	6A
Y10B	107	6B
Y10C	108	6C
Y10D	109	6D
Y10E	110	6E
Y10F	111	6F

I/O address input (Y)	S-LINK address	
	Decimal	Hexadecimal
Y110	112	70
Y111	113	71
Y112	114	72
Y113	115	73
Y114	116	74
Y115	117	75
Y116	118	76
Y117	119	77
Y118	120	78
Y119	121	79
Y11A	122	7A
Y11B	123	7B
Y11C	124	7C
Y11D	125	7D
Y11E	126	7E
Y11F	127	7F

12.10 Binary/Hexadecimal/BCD Expressions

Decimal	Hexadecimal	Binary	BCD code
0	0000	00000000 00000000	0000 0000 0000 0000
1	0001	00000000 00000001	0000 0000 0000 0001
2	0002	00000000 00000010	0000 0000 0000 0010
3	0003	00000000 00000011	0000 0000 0000 0011
4	0004	00000000 00000100	0000 0000 0000 0100
5	0005	00000000 00000101	0000 0000 0000 0101
6	0006	00000000 00000110	0000 0000 0000 0110
7	0007	00000000 00000111	0000 0000 0000 0111
8	0008	00000000 00001000	0000 0000 0000 1000
9	0009	00000000 00001001	0000 0000 0000 1001
10	000A	00000000 00001010	0000 0000 0001 0000
11	000B	00000000 00001011	0000 0000 0001 0001
12	000C	00000000 00001100	0000 0000 0001 0010
13	000D	00000000 00001101	0000 0000 0001 0011
14	000E	00000000 00001110	0000 0000 0001 0100
15	000F	00000000 00001111	0000 0000 0001 0101
16	0010	00000000 00010000	0000 0000 0001 0110
17	0011	00000000 00010001	0000 0000 0001 0111
18	0012	00000000 00010010	0000 0000 0001 1000
19	0013	00000000 00010011	0000 0000 0001 1001
20	0014	00000000 00010100	0000 0000 0010 0000
21	0015	00000000 00010101	0000 0000 0010 0001
22	0016	00000000 00010110	0000 0000 0010 0010
23	0017	00000000 00010111	0000 0000 0010 0011
24	0018	00000000 00011000	0000 0000 0010 0100
25	0019	00000000 00011001	0000 0000 0010 0101
26	001A	00000000 00011010	0000 0000 0010 0110
27	001B	00000000 00011011	0000 0000 0010 0111
28	001C	00000000 00011100	0000 0000 0010 1000
29	001D	00000000 00011101	0000 0000 0010 1001
30	001E	00000000 00011110	0000 0000 0011 0000
31	001F	00000000 00011111	0000 0000 0011 0001
:	:	:	:
63	003F	00000000 00111111	0000 0000 0110 0011
:	:	:	:
255	00FF	00000000 11111111	0000 0010 0101 0101
:	:	:	:
9999	270F	00100111 00001111	1001 1001 1001 1001

12.11 ASCII Codes

				b7								
				b_6	0	0	0	0	1	1	1	1
				b_5	0	0	1	1	0	0	1	1
				b_4	0	1	0	1	0	1	0	1
b7	b_6	b_5	b_4	ASCII HEX code	Most significant digit							
b_3	b_2	b_1	b_0	Least significant digit	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DEL	SPACE	0	@	P	‘	p
0	0	0	1	1	SOH	DC$_1$	!	1	A	Q	a	q
0	0	1	0	2	STX	DC$_2$	”	2	B	R	b	r
0	0	1	1	3	ETX	DC$_3$	#	3	C	S	c	s
0	1	0	0	4	EOT	DC$_4$	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	’	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	¥	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	_	o	DEL

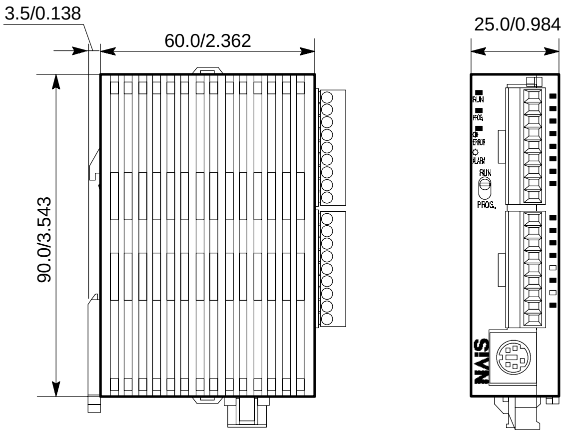
Appendix A

Dimensions

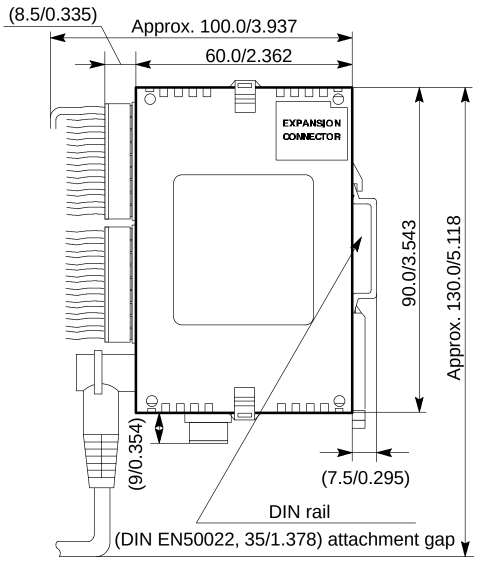
A.1 Control Unit and Expansion I/O Unit

A.1.1 FP0-C10RS/C10CRS/C14RS/C14CRS/E8RS/E16RS

Illustration: FP0-C14RS



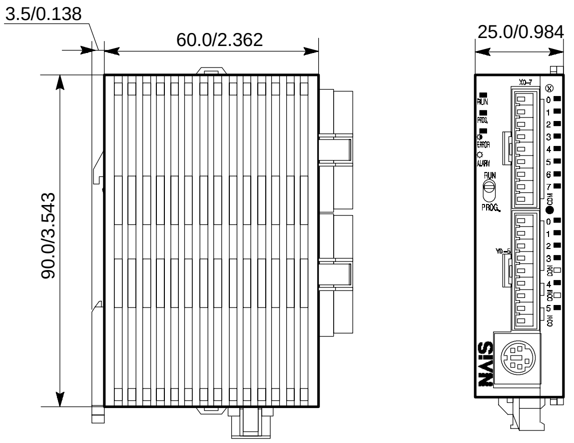
Reference measurements for wiring



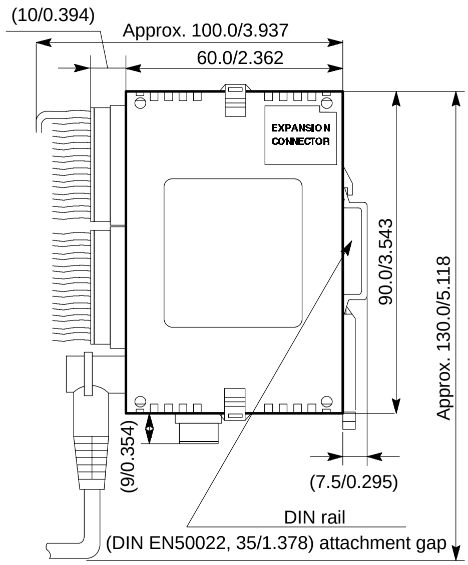
(unit: mm/in.)

A.1.2 FP0-C10RM/C10CRM/C14RM/C14CRM/E8RM/E16RM

Illustration: FP0-C14RM



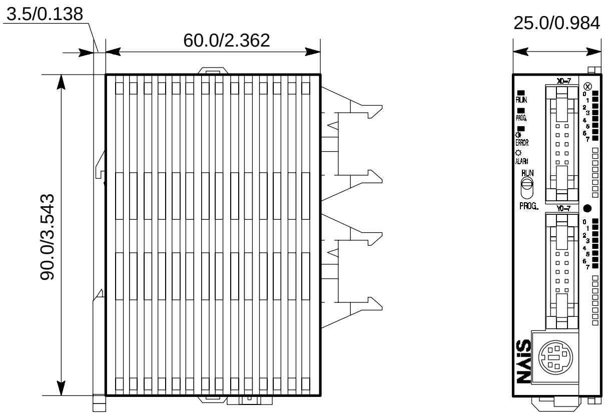
Reference measurements for wiring



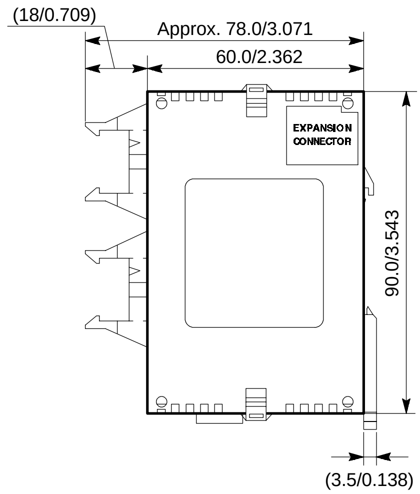
(unit: mm/in.)

A.1.3 FP0-C16T/C16CT/C16P/C16CP/E16T/E16P/E8X/E8YT/E8YP/E32T/E32P/E16X/E16YT/E16YP

Illustration: FP0-C16T



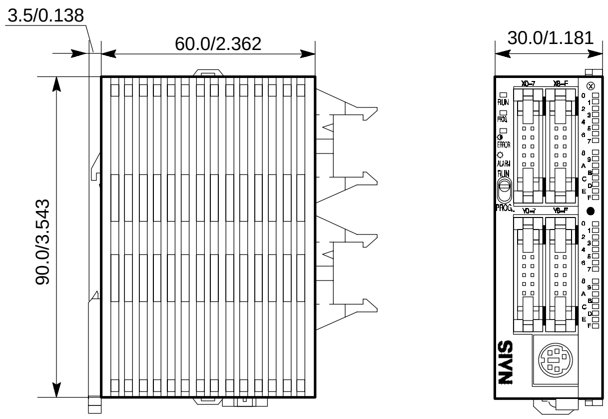
Reference measurements for wiring



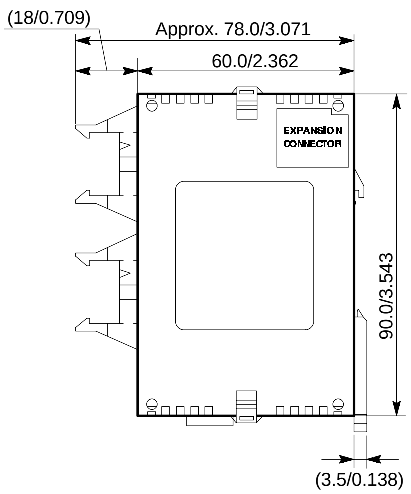
(unit: mm/in.)

A.1.4 FP0-C32T/C32CT/C32P/C32CP/T32CT/T32CP

Illustration: FP0-C32T

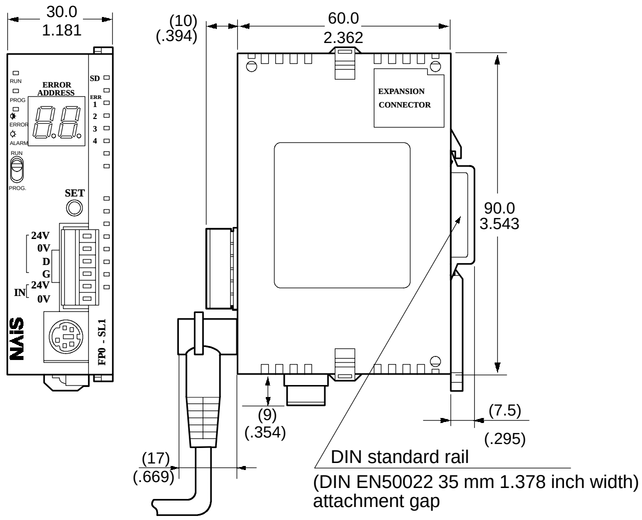


Reference measurements for wiring



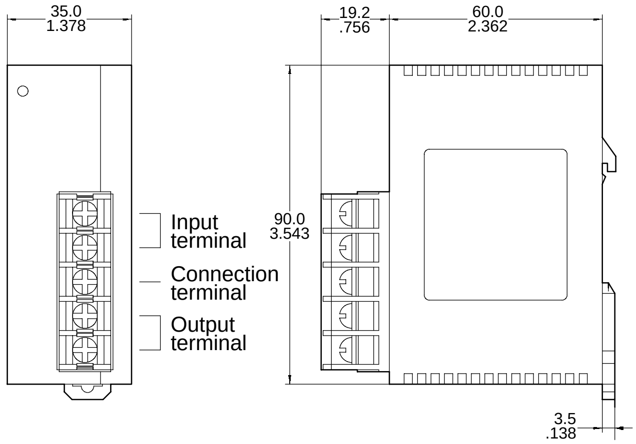
(unit: mm/in.)

A.1.5 FP0 S-LINK Control Unit



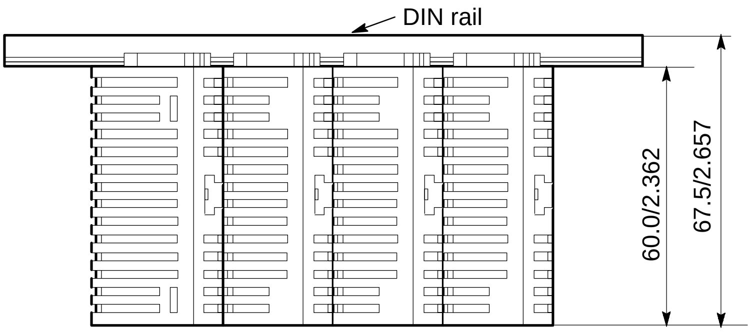
(unit: mm/in.)

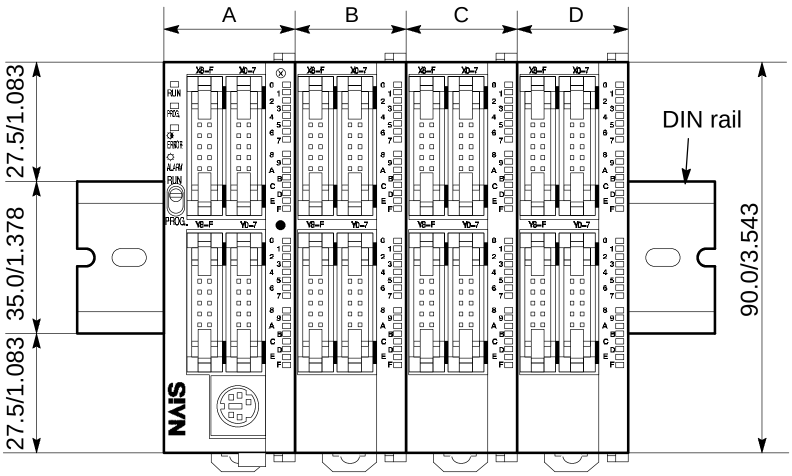
A.2 FP0 Power Supply Unit



(unit: mm/in.)

A.3 Mounting on DIN Rail





(unit: mm/in.)

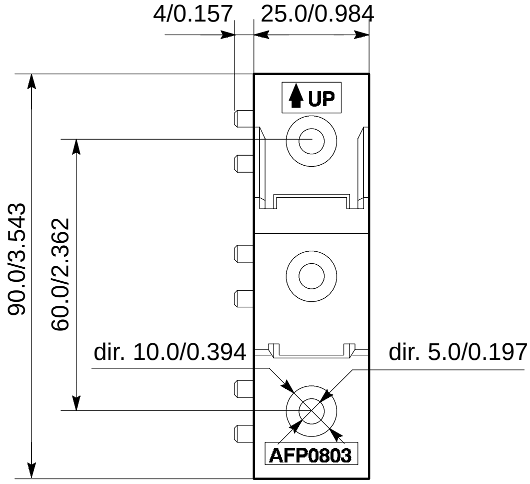
Note

A + B +C + D dimensions (Unit: mm/in.)

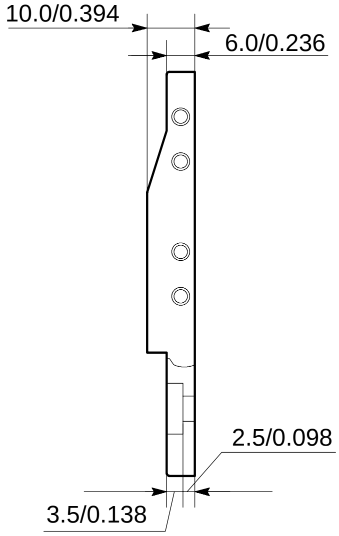
Control unit type	A (Control unit only)	A+B (1 expansion unit connected)	A+B+C (2 expansion units connected)	A+B+C+D (3 expansion units connected)
C10RS, C10CRS, C10RM, C10CRM, C14RS, C14CRS, C14RM, C14CRM, C16T, C16CT, C16P, C16CP	25/0.984	50/1.969	75/2.953	100/3.937
C32T, C32CT, C32P, C32CP	30/1.181	55/2.165	80/3.150	105/4.134

A.4 FP0 Slim Type Mounting Plate

One plate

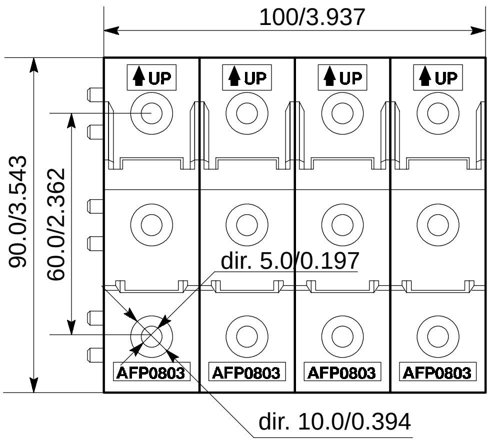


(unit: mm/in.)

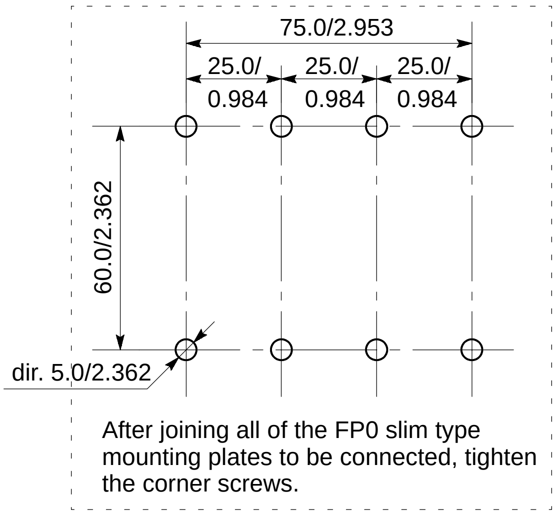


(unit: mm/in.)

Four plates in series

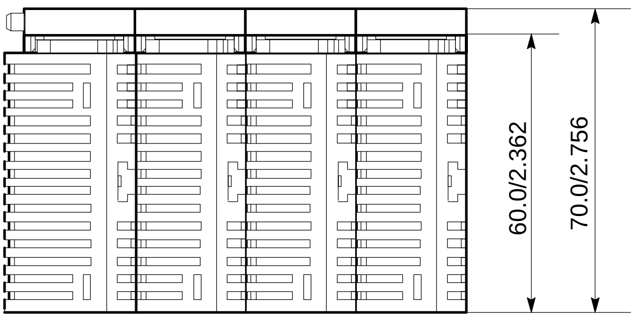


Mounting hole dimensions



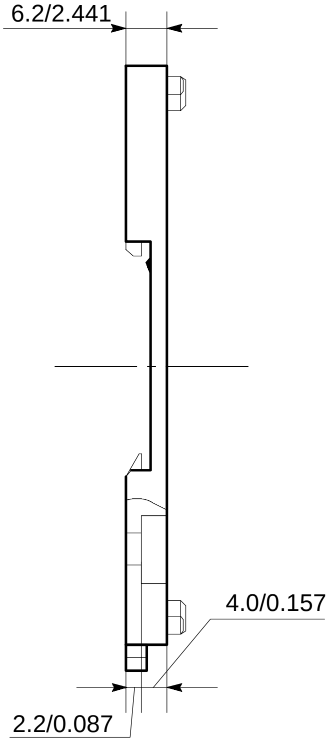
(unit: mm/in.)

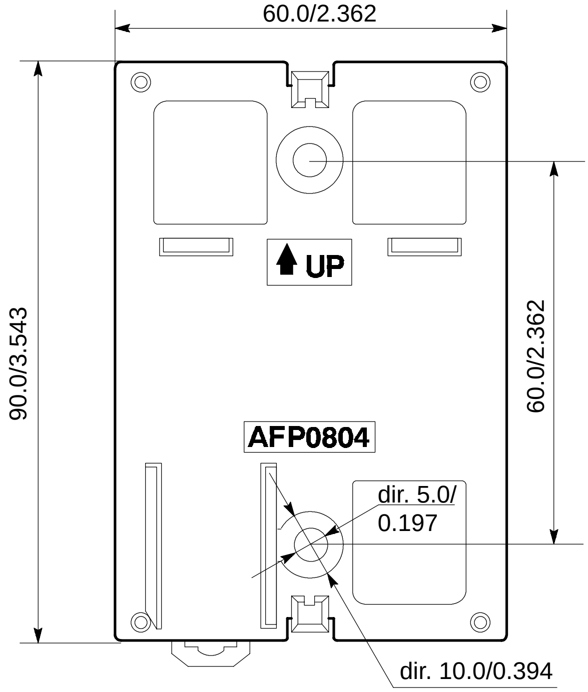
Dimensions when using FP0 slim type mounting plate



(unit: mm/in.)

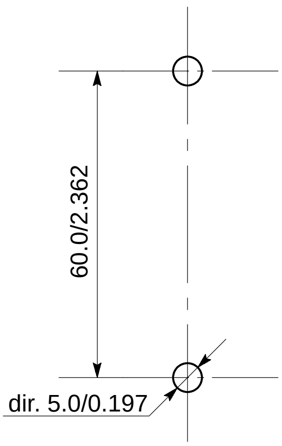
A.5 FP0 Flat Type Mounting Plate



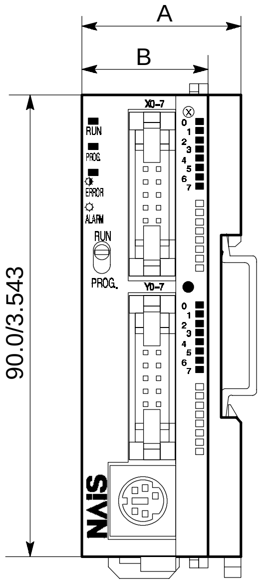


(unit: mm/in.)

Mounting hole dimensions



Dimensions when mounted on DIN rail



(unit: mm/in.)

Unit type	A (mm/in.)	B (mm/in.)
C10RS C10CRS C10RM C10CRM C14RS C14CRS C14RM C14CRM C16T C16CT C16P C16CP	31.2/1.23	25/0.98
C32T C32CT C32P C32CP	36.2/1.43	30/1.18

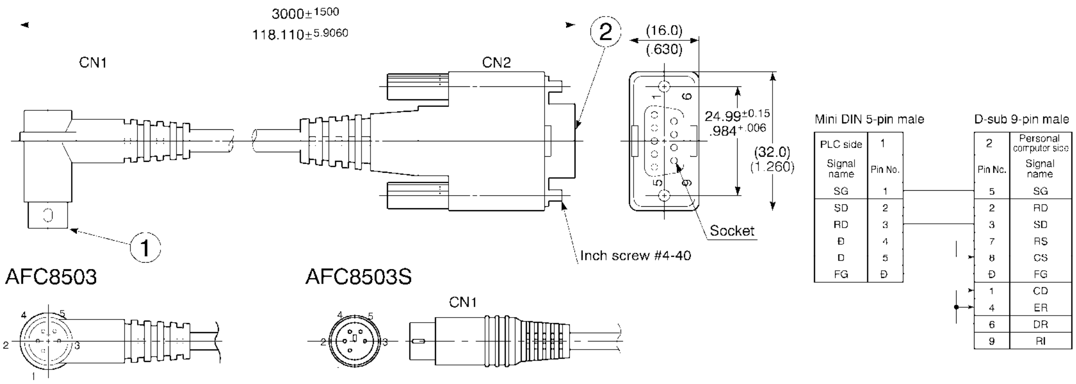
Note

Cannot be used if system is expanded

A.6 Detailed Specifications of Cables

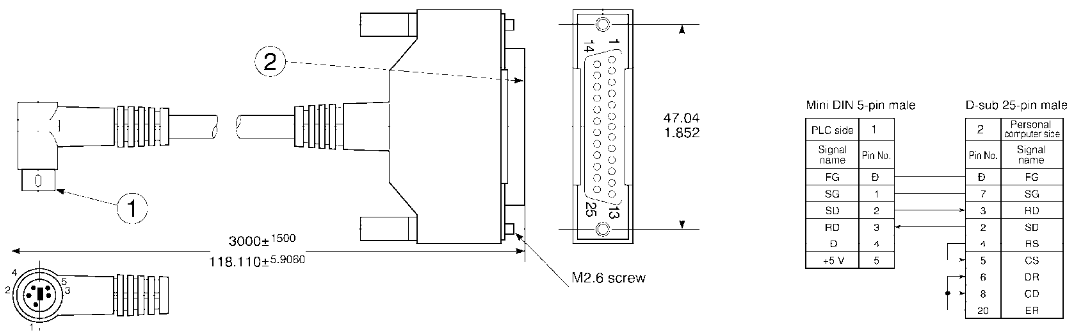
■ AFC8503 and AFC8503S (For connection between FP0/FP2/FP-M and personal computer)

(mm/inch)



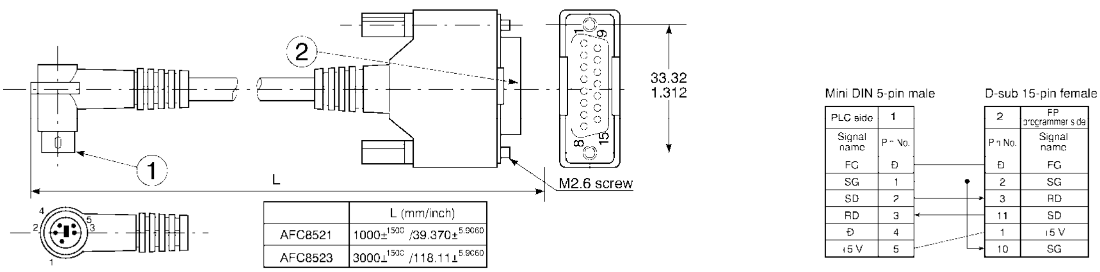
■ AFC8513 (For connection between FP0/FP2/FP-M and personal computer)

(mm/inch)



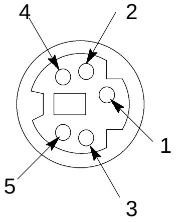
■ AFC8521/AFC8523 (For connection between FP0/FP2/FP-M and FP programmer)

(mm/inch)



	L (mm/inch)
AFC8521	1000±1500 /39.370±5.9060
AFC8523	3000±1500 /118.11±5.9060

Layout of Programming Port Pins Common for the FP0/FP2/FP-M

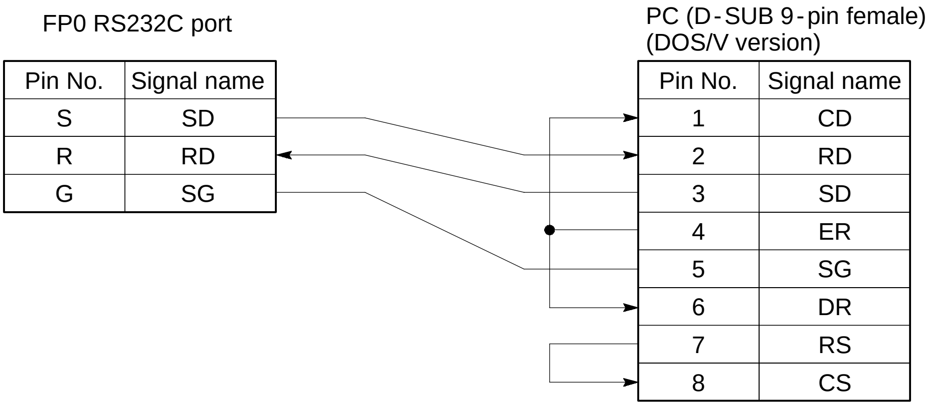


Signal name	Pin No.
SG	1
SD	2
RD	3
-	4
+5V	5

The controller's tool port is provided with the MD-S5100-10 connector for FP0 made by JST Mfg. Co., Ltd. with the TCS7658-01-201 connector for FP-M made by Hoshiden Corporation.

A.7 Connection (between RS232C port and PC)

Connection example



Record of changes

ACG No.	Date	Description of Changes
ACG-M0084-1	JAN. 1997	First edition
ACG-M0084-2	JUL. 1997	2nd edition - Size change (from A5 to B5) - Newly addition of FP0 transistor output type information
ACG-M0084-3	JUN. 1998	3rd edition - Descriptions for FP0 control units with RS232C port are added. - Descriptions for FP0 input only and output only type expansion units are added. - Descriptions for FP0 analog I/O unit is added.
ARCT1F389E	FEB. 2004	4th edition - Programming Manual (ACG-M0084-3) Chapter 4, Chapter 5, Chapter 6, Chapter 8 - S-LINK Control Unit ARCT1F263E Addition - Chapter 8 Connecting the I.O.P. Display Panel - Chapter 9 Trial Operation Delete

These materials are printed on ECF pulp.
These materials are printed with earth-friendly vegetable-based (soybean oil) ink.

PRINTED WITH SOY INK™

Please contact ....

Matsushita Electric Works, Ltd.

Automation Controls Company
K Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan
K Telephone: +81-6-6908-1050
K Facsimile: +81-6-6908-5781
http://www.nais-e.com/

ARCT1F389E 200403-3ZT
ACG-M389E

Specifications are subject to change without notice.

Printed in Japan.